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AN EVALUATION OF THE ESSO PLAZA FITNESS AND LIFESTYLE PROGRAM:
1981 - 1990

by

Ian Pike ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Department of Physical Education and Sport Studies

Edmonton, Alberta

Fall, 1995

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Date August 28, 1995

I think that the study of the contribution of physical activity to improved health and lifestyle will be one of the most important for us to understand. Whether physical activity results in better health as a consequence of improved physiology and reduced physical risk, or whether physical activity contributes to health by acting as a catalyst for positive change in other lifestyle behaviours, or whether physical activity improves health through the creation of positive attitudes and beliefs will, I think, be the next most important contributiontion to the understanding of improved health. Students would do well to pursue greater understanding in these areas through ... Physical Activity Studies.

Neil Sherlock
March, 1933 - June, 1993
Dean
Faculty of Physical Activity Studies
University of Regina

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "An Evaluation of the Esso Plaza Fitness and Lifestyle Program: 1981 - 1990" submitted by Ian Pike in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dr. R.S. Wanzel

Date 26.7.95

DEDICATION

Throughout life we make the acquaintance of many, many people.
Of all of these people, if we make even one true friend we are blessed.
I am truly blessed.

This dissertation was only possible
with the extreme love, patience and understanding of my best friend.
Bobbe. I love you, forever.

ABSTRACT

The present investigation utilized three related studies to: I) evaluate the effect of participation in an in-house fitness and lifestyle program on selected individual measures of health-related physical fitness, lifestyle behaviours and self-reported health status; ii) test the relationships between program participation and illness absenteeism; and, iii) identify the individual measures of health-related physical fitness, lifestyle behaviours and self-reported health status that determine illness absenteeism.

Physical fitness, lifestyle and health data were collected at the time of program entry, and at yearly intervals while membership was maintained and were available for 3,080 members for the period 1981 to 1990 . This investigation was restricted to company-classified "illness absences" and data were confined to the period 1986 to 1990 and available for a total of 1,197 employees.

Participation in the fitness and lifestyle program was associated with minimal improvements in physical fitness and had the effect of maintaining "average" levels of fitness, and a possible "protection" from the functional decline normally associated with ageing. During the ten year period of this study, the proportion of program participants at health risk due to obesity reduced by an average 10%, in stark contrast to Canadian population data for the same period, which indicated a secular trend to increased fatness. Program participation was associated with changes in lifestyle behaviours and health status that would be considered in a direction toward positive health.

The present study found no support for the hypothesis that program participation is associated with significantly reduced absence among participants. Rather, the results suggest that illness absence can be explained by length of

employment and personal variables alone, and that the degree to which one is active in the workplace fitness and lifestyle program is of little consequence.

The results suggest two explanatory models for illness absence among program participants. The distinguishing characteristic being whether employees who dropped out of the program within their first year of membership were included or omitted from the analyses. The major influence was on the significance of leisure time physical activity as a predictor of sick time usage. With dropouts included in the model, leisure time physical activity entered as a significant predictor.

As a group of covariates, personal characteristics accounted for the greatest variance in illness absenteeism, with smoking and marital breakdown as the most important predictors. Physical fitness variables, with the exception of flexibility, failed to achieve significance. Fitness and lifestyle program participation failed to predict illness absence, due, in part, to the lack of differences in annual absence rates between program members and non-members.

The positive association between length of program participation and illness absence was the result of an association between length of service at Esso and absence, and not program participation, *per se*. This conclusion arises from the lack of any difference between program members and non-members in annual rates of sick leave usage.

It was concluded that program participation was associated with positive changes and the maintenance of fitness, lifestyle and health. Program participation *per se* was not associated with rates of illness absence, though personal characteristics which included the amount of leisure time physical activity were significant predictors of illness absence.

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This author would like to thank the members of his supervisory committee for their valuable contributions to the completion of this dissertation. Dr. C. Hazlett, Dr. M. Long and Dr. D. Saunders, for their input to the design of the investigation, and a greater understanding of the measurement of health status. Dr. J. Sefton and Dr. W. Rodgers, who jumped in at the last minute, and Dr. G. Glassford who chaired the candidacy and final examining committees, many thanks for the time and attention in challenging me to a better understanding of physical activity and health. In particular, I would express my deepest appreciation to Dr. A. Quinney, my supervisor, for his tireless support, encouragement and insight. I am honoured, and a much richer person for having worked with you, Art. Thank you.

Thanks are extended to Dr. T. Taerum for helping me to "dump from tape" and integrate the several data bases used in this study, and to Dr. M. McKinnon whose assistance with the final data analysis was invaluable.

The completion of this project would not have been possible without the cooperation of several individuals at Esso. My thanks are extended to Mr. J. Kolaczek, Ms. T. Harris, Dr. D. Dahlman and to Mr. Neil Speers, Fitness Centre Director.

I would like to thank my fellow graduate students whose friendship and support was so valuable. In particular, my house mates Jerry and Steve. It was great.

Finally, my deepest thanks Bobbe, Cori and Alex, for your love and support.

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1. INTRODUCTION

During the past ten to fifteen years a revolution in attitudes towards employee well-being has taken place in many corporate organizations in North America. This revolution finds its origins in rapidly increasing health insurance premiums and medical care costs, and is fueled by a growing body of evidence to suggest that company health care costs are strongly related to employee lifestyle and health behaviour patterns. It seems logical, therefore, that behaviour-related improvements in health should lead to containment of costs, and workplace health promotion programs have flourished in response to this. While the actual content may vary as a function of corporate culture, resources and company objectives, these programs tend to have in common an emphasis on personal responsibility towards health, and generally include some form of health screening followed by intervention strategies related to physical activity, nutrition, smoking, weight control, stress management, and similar other health risk factors.

Enthusiasm for health promotion programs in the workplace derives not only from an intrinsic logical appeal, but also from a growing body of professional and scientific literature supporting the relationship between employee health and corporate benefits. The literature is characterized by more than three hundred, fifty reported program evaluation studies, with a large number of secondary descriptions of program results. This data, however, is not conclusive. Much of the literature is strong on enthusiasm and rather low on proven fact; there are few well-designed scientific studies that provide strong evidence of the link between the workplace program and individual and organizational outcomes. This may be due, in part, to the fact that many such programs have been in existence for a relatively short period of time, or that many companies do not feel compelled to go to the trouble and expense of having their evidence scientifically validated. It is sufficient for them to know that the program works as defined by their own internal criteria.

Nevertheless, in times of economic constraint, when justification for the implementation or continuation of programs depends increasingly upon objective achievement and outcome measures, many corporate directors require evidence based upon sound scientific investigation that will assist them with policy decisions. This investigation represents, in part, an attempt to assist with workplace health promotion policy development through a retrospective evaluation of a fitness and lifestyle program at Esso Resources Canada, Headquarters, Calgary, for the period 1981 to 1990. The evaluation will focus on individual health-related outcomes which are important determinants by which the sponsors of the Esso Plaza Fitness Centre can assess the "worth" of the fitness and lifestyle program. To the extent that other workplaces have similar programs and workforces, the results may assist other corporate decision-makers who are currently operating, or considering the implementation of fitness and lifestyle programs for their employees.

1.1 STATEMENT OF THE PROBLEM

1.1.1 Physical Activity, Fitness and Health

Previous research has shown that regular physical activity contributes positively to physical fitness, health-related lifestyle behaviours and to self-assessed health; the latter being taken as a general indicator of health status. Physical activity may also reduce the incidence and severity of illness and chronic disease and perhaps extend the lifespan by a few years. Consequently, regular physical activity has gained wide acceptance as one component of a healthful lifestyle.

The interrelationships between physical activity, fitness, lifestyle and health outcomes are, however, complex, and as yet not well understood. Paffenbarger, et al. (1990), have represented these interrelationships as a series of ratios:

Active	:	Fit	:	Healthy	:	Long-lived
Sedentary		Unfit		Diseased		Short-lived

Both above and below the line, the progression of these characterizations is, according to Paffenbarger, et al. (1990), a cause-and-effect sequence leading to either desired, or detrimental results. When the model is observed more closely, however, other patterns of influence besides the mainline cause-and-effect are apparent. Physical activity can develop fitness. Lack of physical fitness can limit physical activity. Disease can reduce or ruin fitness and affect physical activity. Physical activity resulting in fitness can reduce or avoid disease and improve quality of life or even lengthen it. The complexity of the interrelationships is in need of further clarification.

Resulting from the International Conference on Exercise, Fitness and Health (Toronto, Canada, 1988), Bouchard, et al. (1990) developed a model describing the interrelationships among habitual physical activity, fitness, lifestyle and health (Figure 1.1). Other factors beyond activity and fitness are associated with individual differences in health status. Similarly, level of fitness is not determined entirely by level of habitual physical activity. Other components affect the major factors in the model and any measure of the relationships between physical activity, fitness and health status must consider variables related to individual lifestyle, personal attributes and behaviours, among others.

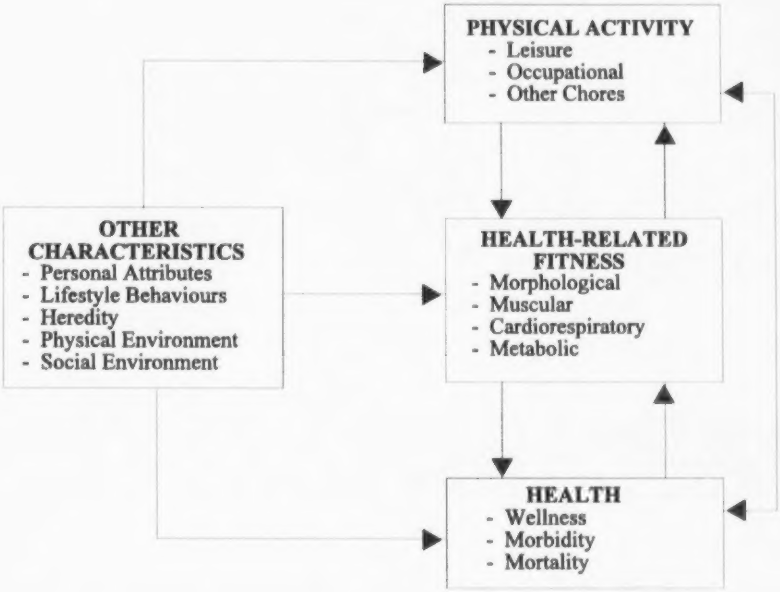
Some researchers have assumed a unitary model for the development and maintenance of preventive health behaviour, stating that healthful lifestyle practices unlikely to be a result of a behavioural adaptation to physical activity *per se*, but rather a general state of attention or mindfulness to some common characteristic such as concern for health (Langer, 1988).

A better understanding of the relationships between physical activity and other health-related behaviours is important. While the amount of physical activity required to improve measures of physical fitness is well understood, in particular need of clarification is the amount of physical activity associated with positive changes in other lifestyle and health-related outcomes. Additional studies are needed to determine if converting from a sedentary to an active lifestyle is accompanied by changes in smoking, dietary, and other health-related behaviours.

1.1.2 Physical Activity, Fitness, Health and Illness Absenteeism

If activity can lead to the adoption of other beneficial health habits, physical activity programs can be the centrepiece of health promotion efforts. Coupled with the fact that the workplace provides a good setting to reach large numbers with health promotion information, workplace fitness and lifestyle programs which are centred around physical activity programs may be a cornerstone in changing societal behaviours towards improved health. To the extent that workplace fitness and lifestyle programs are successful in changing individual health-behaviours, it has been suggested that outcomes of economic importance to the corporation can also be positively affected. These include an improved corporate image, increased productivity, and a reduction in rates of employee turnover and absenteeism.

Figure 1.1 The Relationships among Habitual Physical Activity, Fitness, Lifestyle and Health.



Source: Bouchard, C., et al. (eds.), Exercise, Fitness and Health: A Consensus of Current Knowledge. Human Kinetics Publishers, Inc., Champagne, Ill., 1990.

The rationale for these corporate returns stems from four lines of reasoning. The first is that fitness and lifestyle programs are attractive to employees. It is estimated that approximately 11% of the Canadian population are physically active at an intense and regular enough rate to produce cardiovascular fitness improvements; and another 40% are active enough to produce at least some positive health benefit (Stephens & Craig, 1990). As more individuals recognize the benefits of a physically active lifestyle, the ability to do so during the work day will become more important. Thus, fitness and lifestyle programs are attractive because they reflect the concern an organization has for its employees. This, in turn, provides for an improved image of the company by employees and others.

In line with this reasoning, employee fitness and lifestyle programs are also viewed as a mechanism for recruiting and retaining employees (Debats, 1981). An increase in participation in physical fitness programs has occurred in young adults, who are well educated and of the higher socioeconomic groups (Dishman, et al., 1985; Stephens, et al., 1985; Stephens & Craig, 1990). Thus, corporate fitness and lifestyle programs may be an important mechanism in the recruitment and retention of those individuals the company finds most desirable. And to become a workplace of choice in a competitive business environment is highly desirable.

A second rationale is that employee fitness and lifestyle programs may reduce absenteeism; and as absenteeism is considered to be among the major problems facing most North American companies, this amounts to an important corporate return . Reductions in absenteeism result from a general improvement on the part of the employee to deal with the impact of stress (Perks, 1985; Tucker, et al., 1990a). Corporations are increasingly more concerned with the effects of high levels of stress on employees, and the resultant decrease in work performance; lower productivity; increased turnover and accident rate, and long-term disability (Galt, 1985). Employee fitness and lifestyle programs are thought to reduce the impact of stress through several psycho-physiologic pathways as a result of improved levels of physical fitness and health (Driver & Ratcliff, 1982).

The third rationale is that employee fitness and lifestyle programs can lead to improved levels of productivity, achieved through reduced absenteeism and turnover. This rationale follows the first two; namely that improved fitness and health and reduced stress lead to reduced absenteeism and turnover, and consequently increased productivity. As well, it is assumed that the increased capacity for physical work derived from improved fitness levels will transfer to an ability to work longer and harder at mental tasks. This transfer from physical to mental capacity is expected to improve productivity in employees where concentration and mental effort is required (Pravosudov, 1978; Heinzelman, et al., 1970). However, proponents of this link are cautious about the extent to which research will be able to demonstrate the relationship (Howard & Mikalachki, 1979).

Finally, companies who sponsor employee fitness and lifestyle programs feel that they produce a positive return on investment. It is reasoned that a workforce that is more fit, that displays healthier lifestyles, that has reduced stress-related illness and absenteeism, and less accidents, realizes a considerable saving through reductions in health-related costs. Companies who sponsor fitness and lifestyle programs report savings as a result of reduced premiums for group life insurance plans, Worker's Compensation Board payments, extended health care plans, as well as costs related to immediate treatment for injury, such as first-aid and dispensary supplies (Shephard, 1986).

The validity of these positive conclusions has been questioned since health costs and behaviours, in particular, were often estimated based upon theoretical prospective relationships or inconsistent data (Oster, et al., 1984; Oster & Epstein, 1986; Shephard, et al., 1982). Furthermore, many of the studies have been criticized for the lack of appropriate research design and/or statistical tests to evaluate hypotheses (Bly, et al., 1986; Brink, 1987; Golaszewski, et al., 1989; Jose, et al., 1987; Reed, et al., 1986).

There is still a lack of strong evidence to support the association between participation in workplace fitness and lifestyle programs and personal lifestyle and health-related behaviours. Such evidence is critical to the emerging field of workplace fitness and healthy lifestyle promotion. Scientific models need to be adapted or developed upon which a focused research program can proceed. Further, studies are needed that test the potential long-term effects of participation in workplace fitness and lifestyle programs. To date, most studies are cross-sectional in nature, or are limited to relatively short term investigations (2 to 3 years).

Few workplace programs have been in existence for more than a decade, and fewer have systematically collected data appropriate for use in research. Consequently, there is a paucity of literature describing the health-related outcomes following long term participation. Further investigation that can elucidate the relationships between participation in workplace fitness and lifestyle programs and health-related outcomes is important from a practical and scientific viewpoint.

1.2 PURPOSE OF THE INVESTIGATION

Thus, the purpose of this investigation was twofold. Firstly, to conduct an evaluation of the fitness and lifestyle program that would assist corporate directors at Esso Resources Canada, Headquarters, with workplace health promotion policy development. The measurement of changes in selected individual health-related outcomes would enable an evaluation of the program to date, as well as identify areas for future policy and program development. The program evaluation portion of this investigation was established to meet the following three objectives:

1. To describe participation in the fitness and lifestyle program for the period 1981 to 1990.

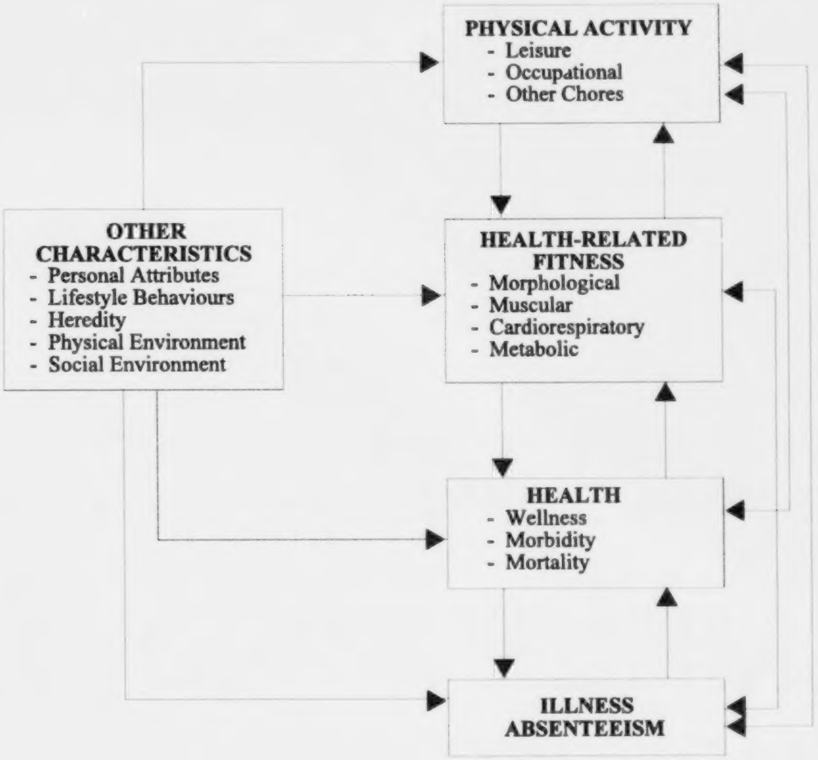
2. To describe physical fitness, lifestyle behaviours and self-reported health status in fitness and lifestyle program members for the period 1981 to 1990.

3. To describe rates of illness absenteeism in fitness and lifestyle program members, drop-outs and non-members for the period 1986 to 1990.

Secondly, using the model proposed by Bouchard, et al. (1990) as the theoretical framework, the investigation will test the relationships between long-term participation in a workplace fitness and lifestyle program which is centred around physical activity, and selected individual measures of health-related physical fitness, lifestyle behaviours, self-reported health status, and illness-absenteeism.

The model proposed by Bouchard, et al. (1990) does not include a consideration of illness absenteeism. Previous literature, however, reasons that employees who are more healthy will be absent less due to a decrease in the frequency and severity of illness. While this inverse relationship is also affected by certain individual characteristics relating to personal lifestyle, and socio-demographic attributes, it is nonetheless generally agreed upon. An addition to the model is, therefore proposed (Figure 1.2).

Figure 1.2 **The Relationships among Habitual Physical Activity, Fitness, Lifestyle, Health and Illness Absenteeism.**



Adapted from: Bouchard, C., et al. (eds.), Exercise, Fitness and Health: A Consensus of Current Knowledge. Human Kinetics Publishers, Inc., Champagne, Ill., 1990.

The relationships between activity, fitness, lifestyle and health, and illness absenteeism have been postulated based upon existing research and the previously discussed rationale. In addition to the lines between health status and illness absence, and personal characteristics and illness absence, a direct line from the physical activity program to illness absence is included. This direct link is derived from the previous discussion relating to the attractiveness of the physical activity program to employees who regard the opportunity to engage in physical activity an important one.

The second part of the investigation is similarly established to meet three objectives:

1. To determine if level of participation in the fitness and lifestyle program is significantly related to measures of physical fitness, lifestyle behaviours and self-reported health status.
2. To determine if level of participation in the fitness and lifestyle program is significantly related to rates of illness absenteeism.
3. To predict rates of illness absenteeism from fitness and lifestyle program participation, lifestyle behaviours, health status, job and personal characteristics.

1.3 SCOPE OF THE INVESTIGATION

The investigation is subject to the following delimitations and limitations.

1.3.1 Delimitations

This investigation is delimited to employees of Esso Resources Canada who were employed on a full-time basis at the Headquarters building in Calgary, Alberta, Canada, at any time during the period January 1, 1981 to December 31, 1990. Thus, the results generated from this employee population may not be generalizable to other employee populations.

The physical and physiological variables measured to assess health-related physical fitness were delimited to the battery of tests included in the Canadian Standardized Test of Fitness (1981).

The lifestyle and health status variables were delimited to self-reported responses to a paper and pencil questionnaire. The questionnaire was not previously validated, though the questions were similar to others previously reported in the literature. From this standpoint, the questionnaire appears to have, at least, good face validity.

This investigation is concerned only with absences due to the employee's own illness. The measurement of absence from work is delimited to company-classified "illness absence", and is defined as the number of days away from work due to personal illness in one year.

1.3.1 Limitations

Fitness and lifestyle program members represented a self-selected sample from the population of employees, and were not randomly assigned. It is therefore possible that they represent a different population of employees than the non-members. The nature of this self-selection may, therefore, affect the strength of any conclusions about the effects of participation in the workplace fitness and lifestyle program.

The quality of the data bases used to evaluate the relationships between fitness and lifestyle program participation and individual health-related outcomes may be a limitation. The data were collected over a period of ten years, and were entered to a computer tracking system by a variety of different individuals. The possibility of mistakes and inconsistencies as a limiting factor is thereby acknowledged. The data, however, were subjected to extensive cleaning procedures, which included line by line examination. Missing data were entered after consultation with original paper data collection sheets. Where data difficulties could not be resolved, the case was excluded from the analyses.

Lifestyle behaviours and health status information was collected via a self-reported paper and pencil questionnaire. The extent to which employees were not accurate, or gave socially-desirable responses, in completing this questionnaire may be a limitation of the data. However, it is reasoned that these employees had little incentive to answer questions in an inaccurate fashion as the main purpose of the questionnaire was for personal feedback and monitoring of health-related behaviours from year to year.

Finally, the data related to illness absence may be a limitation in this investigation. To the extent that employees are away from work for purposes other than personal illness, and yet report it as a personal illness absence, the validity of any conclusions may be affected. It is anticipated that this practice however, will be minimal at Esso Resources. Employees work on a flexible schedule and are free to engage in the fitness and lifestyle program at any time throughout the work day. This degree of flexibility also extends to other aspects of the job, and therefore personal tasks that require time from work, that may have been reported as illness absences, are likely to be a very small limitation to the validity of the illness absenteeism data.

1.4 ORGANIZATION OF THE DISSERTATION

The investigation will, by necessity, include several analyses. The organization of the dissertation is intended to maximize the flow of information, and to the understanding related to these several analyses.

Chapter 2 presents a review of the related literature. Physical activity is reviewed from the perspective of its relationship to health through an examination of the relationships with coronary heart disease, other diseases, and from its relationship to other health-related behaviours. A brief history of workplace occupational health programs, and more recently fitness and lifestyle programs precedes a discussion of the literature pertaining to physical activity and absenteeism.

Chapter 3 gives a general presentation of the measurements and methodology used in this investigation. Following this general description, each analysis is presented as an individual study, with the design and statistical methodology pertinent to each separated into individual chapters.

Chapters 4, 5 and 6 provide the detailed description of each of the three related studies conducted within this larger analysis. Each Chapter provides an introduction, purpose and detailed design and methodology of the study, ending with detailed results, discussion and conclusions.

Chapter 7 provides a summary of the findings and conclusions of the overall investigation. A conceptual approach to workplace health promotion programming is presented along with specific recommendations for the sponsors of workplace programs. The Chapter concludes with recommendations for further investigation.

2. REVIEW OF LITERATURE

This chapter contains a review of the literature related to this investigation. It has been organized into six sections. The first is a review of studies demonstrating the relationship of physical activity to reduced incidence of coronary heart disease (CHD). The second recounts studies that associate physical activity with other lifestyle behaviours and health status. Section three reviews the history and development of workplace fitness and lifestyle programs. The fourth section provides a brief overview of the literature discussing the methodological concerns related to conducting fitness, lifestyle and health-related research in the workplace setting. Finally, section five provides a critical review of the studies that address the relationship between workplace physical activity program participation and absence.

2.1 PHYSICAL ACTIVITY AND CORONARY HEART DISEASE

Numerous potential benefits have been claimed by supporters of employee fitness and lifestyle programs, and it is now generally agreed that regular physical activity constitutes a positive health practice. However, definitive evidence, based upon randomized clinical trials in large populations to demonstrate that regular physical activity lengthens life is lacking. We are left, therefore, with indirect evidence; much of which comes from the extensive epidemiological evidence examining the relationship between physical activity and coronary heart disease (CHD). These investigations established a high correlation between active work and lower incidence of deaths due to CHD.

According to Powell, et al. (1987), the general conclusions that can be drawn from these and other similar studies suggest that the risk of coronary heart disease is two to three times greater for inactive people over active people, and active people have twice to three times better chance than inactive people of surviving a first heart attack. He also pointed out that recent physical activity appears to be more pertinent in the prevention of CHD than activity performed earlier in life. Finally, the intensity of habitual physical activity associated with reduced CHD appears to be sufficiently small to be acceptable to many individuals. Low level activities, such as walking and gardening, can provide considerable benefit by reducing the risk of CHD (LaPorte, et al., 1984).

These studies have not been accepted, however, as causal evidence of a link between decreased physical activity and increased incidence of CHD and increased mortality from CHD. The most common criticism of these studies has been that such population studies involve self-selected groups, thus leaving open the possibility that the association is due to CHD-prone individuals selecting more sedentary occupations and lifestyles. A similar argument has been voiced to discourage implementation of workplace fitness and lifestyle programs; that is, only employees who are already fit and who have healthy lifestyles will participate, while those who are unfit or unhealthy will not participate. However, in the Canada Life study (Shephard, et al., 1982), the rebuttal to this criticism suggested that since all employees in the test company were medically screened, it seemed more likely that a poor attitude toward fitness and health, rather than poor fitness and health itself, was the reason for the non-participation.

The work of British epidemiologist, J.N. Morris is regarded as the pioneering effort to describe the increasing incidence of coronary heart disease (CHD). Analyzing figures obtained from the Registrar General for births, marriages and deaths for England and Wales, he showed that there had been a progressive increase in the number of older men dying from the manifestation of CHD between 1931-33 and 1946-48 (Morris, 1951). Other epidemiological work demonstrated the existence of similar trends in Canada (Anderson & Le Riche, 1970; Halliday & Anderson, 1979) and the USA (Anderson, 1976). Increases in the incidence of sudden death due to CHD left little possibility that the rising mortality rate was caused by other factors.

Morris and his associates (1953), were the first to attract serious interest to the hypothesis that occupational physical inactivity is a contributing risk factor for CHD. The level of physical activity, as used in these studies, was based upon the independent evaluation of the occupation by industrial experts. The activity level of the last job was found to be inversely related to mortality from CHD (determined from death certificates).

2.1.1 London Transport System Workers

Morris (1975), presented data from a series of epidemiological studies to support the hypothesis that men in physically active jobs have a lower incidence of CHD than men in physically inactive jobs.

> "More important, the disease is not so severe in physically active workers, tending to present first in them as angina pectoris and other relatively benign forms and to have a smaller early case fatality and a lower early mortality rate." (pp. 78).

The first study analyzed 31,000 white males, aged 35-64 years, over a period of 18 months from 1949 to 1950. The end points were coronary insufficiency, myocardial infarction (MI), and angina as reported on sick-leave records, and listing of CHD on death certificates. The age-adjusted total incidence was 1.5 times higher in the driver group than in the conductor group, and the rate of sudden death and 3 month mortality was 2 times higher.

In the original study, Morris did not investigate the differences in selection in the two groups which leads to the question whether the more active and healthy individuals selected the more active conductor jobs in the first place. In a later study, sub-titled "The epidemiology of Uniforms" Morris (1966), reported that the drivers uniforms were in fact 2 inches larger than conductors at job entry. Further, in 1966, Morris also showed that drivers had higher serum cholesterol and higher blood pressures than did the conductors. Also, a study by Oliver (1967), documented, that for reasons not entirely clear, recruits for the two jobs differed in lipid level and body weight. These differences put the drivers at risk of CHD for reasons other than the occupational difference in physical activity.

Despite the cautionary findings, Morris' work had drawn considerable interest to the hypothesis of physical inactivity as a risk factor to CHD. Several other investigators proceeded with prospective studies that alleviated many of the pitfalls of the retrospective studies of Morris and his associates. More recently, the studies of longshoremen in San Francisco by Paffenbarger, et al. (1977, 1978), of civil servants by Morris, et al. (1980), of Harvard graduates by Paffenbarger, et al. (1978, 1983) and of individuals in the Framingham Study by Kannel, et al. (1986), are of importance in determining the link between physical inactivity and the prevalence of mortality and morbidity from CHD.

2.1.2 San Francisco Longshoremen Study

Paffenbarger, et al. (1970), reported numerous analyses of epidemiological data from San Francisco longshoremen. Work on the waterfront had been performed at relatively high activity levels under conditions that were well governed and documented by the longshoremen union. The analyses included a 22 year follow-up (1951-1972) for 59,401 man-years (n = 3,868) of energy expenditure on the job. One third of this experience was classified as high-energy work and the rest as low-energy work by analyzing the energy cost by physical measurements taken in actual on-the-job situations. All subjects were screened for cigarette smoking, blood pressure, history of prior CHD, obesity, glucose intolerance and blood cholesterol.

Death rates from fatal heart attacks were significantly lower for workers who had high-energy cost jobs (> 5.2 Kcal/min. or > 8,500 Kcal/week) compared to workers with low-energy cost jobs (< 5.0 Kcal/min. or < 8,500 Kcal/week). The data also showed that workers with high-energy cost jobs had less risk of sudden death from heart attack. This reduced risk was also apparent among workers with high-energy costs jobs who had prior known CHD. The effect was strongest among men less than 55 years of age, but important in all groups studied. The fact that the relationship between physical activity and a decrease in CHD mortality remained significant after other risk factors for CHD were statistically accounted for, and that an inverse relationship between physical activity and CHD mortality was established makes this a landmark investigation.

2.1.3 British Civil Servants Study

Morris, et al. (1980), and Chave, et al. (1978), assessed the leisure-time activity habits of 17,944 male executive grade civil servants who were between 40 and 65 years of age. Executives who reported vigorous physical activity over a two day sampling period (one week day and one weekend day) demonstrated fewer heart attacks and mortality from CHD. This prospective study had a mean subsequent follow-up period of 8.5 years. Vigorous physical activity was defined as work liable to require peaks of energy expenditure of 7.5 Kcal/min. or more. Estimates of leisure-time in itself, without the vigorous component did not show a relationship with CHD. Although multivariate analysis was not used (Morris, 1980), the relationship between vigorous physical activity, and fatal and non-fatal heart attacks and symptoms of CHD remained significant when family history, height-weight, cigarette smoking, hypertension, blood cholesterol, and diabetes mellitus were taken into account.

2.1.4 Harvard University Alumni Study

Paffenbarger, et al. (1978, 1986), investigated the leisure-time physical activity habits and health status of 16,936 Harvard University male graduates aged 35 to 74 years. Subjects entering college between 1916 and 1950 were assessed by initial physical examinations, self-assessed mail questionnaires, and official death certificates. The follow-up period ranged from 6 to 10 years (1962 or 1966-1972) and 12 to 16 years (1962 or 1966-1978) for the two studies (1978, 1986). Age-specific rates for fatal and non-fatal cardiac events (angina pectoris, myocardial infarction, and sudden death) were inversely related to increased physical activity of up to 2,000 Kcal/week (Figure 5.1).

Men who expended less than 2,000 Kcal/week of extra effort during leisure-time were at a 64% higher risk of having an event resulting from CHD than men who expended more than 2,000 Kcal/week. Approximately 33% of the alumni reported activity levels above 2,000 Kcal/week. Vigorous sport/exercise enhanced the relationship between reduced risk of first heart attack and physical activity. Thus, intensity of effort further increased the benefit derived from physical activity. Athletes who were active earlier in life and who discontinued their physical activity habits tended to be at a higher risk of CHD events than persons who remained sedentary their full life.

Multivariate analyses for estimating death rates showed physical activity to be an independent risk factor for CHD even when adjusted for age, cigarette smoking, early parental death from CHD, body weight gains, total body weight, and hypertension.

2.1.5 The Framingham Study

Approximately 5,000 men and women aged 30 to 62 years and free of clinical evidence of CHD at the onset of the study have been examined regularly since 1949. CHD mortality rates have subsequently been found to be higher in sedentary cohorts. However, physical inactivity did not have the predictive power of the three cardinal risk factors, namely cigarette smoking, hyperlipidemia, and hypertension (Froelicher, 1988). Further analyses by Kannel and associates (1986), demonstrated a rather modest effect of physical activity on overall mortality and CHD mortality when compared to other risk factors. However, the effect persisted even when the other risk factors were statistically accounted for.

2.1.6 The Seattle Study

A recent population-based, case-control study from metropolitan Seattle, WA., examined the relationship between habitual leisure-time physical activity and primary cardiac arrest among persons without a known history of heart disease or significant risk factor prevalence (Siscovick, et al., 1982). Among people who engaged in low levels of habitual physical activity, the overall risk of primary cardiac arrest was increased, as compared to people who engaged in more vigorous habitual physical activity.

2.1.7 Conclusions on Epidemiological Studies

To conclude, the findings from these studies, therefore suggest an association between levels of habitual physical activity and the overall risk of coronary heart disease. This association is reflected in the relative risk estimates in Table 2.1. Paffenbarger (1986), has further summarized the following pertinent findings:

> a) A reduced risk of developing CHD is related to both occupational and leisure-time aerobic practices of vigorous activity. A reduced CHD risk associated with an adequate level of current energy expenditure is lowered further if exercise pattern included sufficient vigorous activity or strenuous burst of energy output.
>
> b) The relationship is dose dependent over a wide range; that is, the greater the energy expenditure... the lower the incidence of CHD, case fatality, mortality and recurrence.

c) The findings are consistent by age of subjects, by sex, and by clinical manifestation of the disease (angina pectoris, myocardial infarction, sudden death, and fatal CHD death).

d) The findings persist over successive increments of time and in careful studies of several diverse populations as cited here.

e) The findings for the influence of exercise are at least partially independent of other host and environmental characteristics associated with CHD risk (cigarette smoking, blood pressure level, weight-for-height status, prior existence of diabetes mellitus, family history of CHD, etc.).

Table 2.1 Physical Activity and Relative Risk of Coronary Heart Disease.

Study Population	Number	Activity	CHD	Risk Ratio
London Transport Workers (Men 35-64)	31,000	Work	Fatal & Non-fatal	0.53
San Francisco Longshoremen (Men 35-74)	6,351	Work	Fatal	0.50
British Civil Servants (Men 40-65)	17,944	Leisure	Fatal & Non-fatal	0.70 fatal 0.50 non
Harvard Univ. Alumni (Men 35-74)	16,936	Leisure	Fatal & Non-fatal	0.50 fatal 0.67 non
Framingham Study (Men & Women 30-62)	5,000	Leisure	Non-fatal	0.40
Seattle, WA. (Men & Women 25-75)	163	Leisure	Cardiac Arrest	0.42

Source: Roberts, A.D. (1982). The Economic Benefits of Participation in Regular Physical Activity, Recreation Ministers' Council of Australia. Canberra, Australia.

There are two possible explanations for these observations. On the one hand, if habitual vigorous physical activity leads to a lower risk of CHD, then exercise might be "protective". On the other hand, if either prior morbidity or other factors lead to a lack of vigorous physical activity, then the association may reflect the "selection" associated with "unwell" or "unfit" people who tend to be less active. The reviewed studies address the issue of "selection versus protection" in several different ways. Firstly, each study started with an apparently healthy population, minimizing the potential contamination of unwell people who tend to be less active. This confounding was recognized and noted by Morris and associates in the study of London transit system workers. Secondly, other potential confounding factors, such as age, smoking, obesity, hypertension and family history, were controlled for in the data analyses. They appeared not to account for the observed relationship between level of physical activity and risk of CHD.

Thirdly, the possibility that constitutional differences between persons who chose to be active and those who are sedentary might explain the association between physical activity and CHD as examined in the Harvard Alumni Study. Activity in adult life appeared independent of activity during college life in predicting a lower risk of heart attack, suggesting that constitutional differences did not account for the association.

Finally, neither excluding cases of CHD that occurred early in the follow up period (Morris, et al., 1980), nor accounting for changes in job classification (Paffenbarger, et al., 1978), altered the relationship between activity and CHD. For these reasons it seems unlikely that the relationship between habitual physical activity and decreased risk of CHD merely reflects "selection".

The epidemiological studies relating physical activity and coronary heart disease, therefore, suggest a possible protective effect for a physically active lifestyle.

2.1.8 Clinical and Experimental Evidence

In order to better understand how physical activity might affect or alter the coronary heart disease process, a brief review of the pathophysiology of the disease is helpful.

Coronary arteries are composed of three distinct layers: the tunica intima or inner layer, the tunica media or middle layer, and the tunica adventitia or outer layer. More simply, these are referred to as the intima, the media, and the adventitia. The innermost layer of the intima is formed by a thin lining of endothelial cells that provide a smooth protective coating between the blood flowing through the artery and the intimal layer of the vessel wall.

Currently, the 'response to injury' theory, supported by considerable experimental evidence, is generally well accepted. This theory views atherosclerosis as an inflammatory disease, in which local injury to the endothelial cells is the initiating event in the disease process (Ross, R., 1986). Blood platelets are attracted to the site of injury and adhere to the exposed layer of the intima. These platelets release platelet-driven growth factor (PDGF) that promotes migration of smooth muscle cells from the media into the intima, which normally contains few if any muscle cells. A plaque, which is composed of smooth muscle cells, connective tissue, and debris, forms at the site of the injury. Eventually, lipids in the blood, specifically low-density-lipoprotein (LDL) cholesterol, are deposited in the plaque.

More recently, researchers have theorized that monocytes, which are effector cells of the immune system, attach between endothelial cells. These monocytes eventually become foam cells, or macrophages, and form fatty streaks. Smooth muscle cells then accumulate under these foam cells. When the endothelial cells separate or are sloughed off, the underlying connective tissue becomes exposed and platelets can attach to it (Ross, R., 1986). In this modification of the original theory, endothelial injury is not always the precipitating event.

Other explanations of the pathogenesis of atherosclerosis have been hypothesized, and are under investigation. However, all seem to agree that the process of atherosclerosis appears to begin with injury to, or disruption of the endothelial cells lining the intima. This leads to a chain of events that eventually develops into an atherosclerotic plaque.

Physical activity and physical fitness are associated with various measures of improved health in clinical observations. Cooper, et al. (1976), reported that men with higher levels of physical fitness were at lower risk for CHD. Fitter men had lower serum cholesterol, triglycerides, glucose, and uric acid; they also had lower blood pressures and less body fat. Gibbons, et al. (1983), reported similar findings for women patients.

Changes in physical fitness are also associated with beneficial changes in some CHD risk factors. Blair, et al. (1984), found that increased treadmill time was significantly related to improvements in high-density lipoprotein cholesterol (HDL), total cholesterol/HDL ratio, and serum uric acid levels in 753 men.

There is overwhelming evidence that regular exercise increases physical work capacity (PWC) (ACSM, 1988). Well-controlled experimental studies have documented the degree of exercise (intensity, frequency and duration) necessary for changing physical fitness. There is now sufficient data on specific exercise programs to make accurate predictions of changes in various physiological variables.

Experimental studies suggest that regular exercise has positive impact on CHD risk factors, particularly on plasma lipoproteins (Wood, et al., 1983). Studies with animal models support the hypothesis of a direct effect of exercise on the atherosclerotic process. For example, Kramsch, et al. (1981), found that sedentary monkeys had lower HDL levels than those who received exercise. Furthermore, the exercised monkeys had less angiographic evidence of CHD, fewer pathogenic ECG changes, and less sudden death. Experimental studies on exercise support the claims of beneficial effects on weight control, psychological status, adult onset diabetes, and certain orthopaedic problems (Haskell & Blair, 1980).

2.2 PHYSICAL ACTIVITY, LIFESTYLE BEHAVIOURS AND HEALTH

The behaviours that constitute an individual's lifestyle are chosen from among those available in the context of the individual's life circumstance. These behaviours, and so one's lifestyle, have an ultimate effect on health status, principally through impacts on the biological systems (Breslow, 1990). The degree to which physical activity may influence other health-related behaviours, such as dietary habits, smoking and alcohol use is an important one in determining the form of future health promotion efforts.

Past evidence links regular physical activity and/or physical fitness with various health behaviours (Allen, et al., 1978; Blair, et al., 1985; Cooper, et al., 1976), and health status (Breslow & Enstrom, 1980; Breslow, 1990). Physical activity is also linked to many perceived benefits. However, it is difficult to state causal relationships, to discern physiological from psychological linkages, or to exclude extrinsic factors such as good initial health, level of formal education completed, or socio-economic status (SES); all of which are known to correlate positively with health status. For example, Shephard, et al. (1980), noted in a study of the employee fitness program at General Foods, that not only participants, but also their spouses and friends had more strongly developed health beliefs than non-participants, suggesting self-selection of those with stronger health beliefs to the program.

2.2.1 Dietary Habits

Community surveys tend to support an inverse relationship between physical activity and body fatness. Similarly, regular physical activity is associated with lower body mass index (BMI) (Blair, et al., 1985; Folsom, et al., 1985; Gibbons, 1983). Though it may be attractive to infer a causal relationship, it is easily argued that obesity prevents physical activity, rather than the converse.

Physically active individuals tend to consume more food than their sedentary counterparts in order to maintain an energy balance. Thus, active individuals tend to increase their intake of vitamins and trace elements. However, as Wood, et al. (1983), and Dickman (1988), have pointed out, food intake may also be related to within group differences in the type of activity engaged in; namely, whether activity is principally strength or endurance in nature.

Research on appetite has demonstrated that it is controlled by a large number of feedback systems. The actual control centre is thought to lie in the hypothalamus, or near it. The appetite control centre is sensitive to a number of factors such as the concentration of glucose in the blood, to a variety of hormones, and to neurotransmitters in the brain that affect mood. At present, it is unknown which of these regulatory factors respond differently to endurance activities as compared to strength activities.

A classic example of how strength type, physical labour increases appetite was reported by Karvonen, et al. (1961), who measured the diets of Finnish lumberjacks and found that their daily intake averaged over 4,700 Kcal. These men were not obese, however, despite consuming almost twice as many calories as more sedentary workers.

Dempsey (1964), measured the food intake of young men who engaged in endurance activity for an hour a day - sufficient to result in considerable weight loss. Their food consumption did not increase. Similarly, experiments with middle-aged men who jogged 3 days per week found that while fitness levels increased, appetite or food intake did not (Holloszy, et al., 1964; Skinner, et al., 1964). Similarly, Woo, et al. (1982a, 1982b), found no spontaneous increase in caloric intake in women who engaged in endurance activity at 110% and 125% of their sedentary energy expenditure.

It thus appears, that the type of activity is important in appetite regulation; the distinction being between the effects of strength and endurance type activities on appetite. The reason for this distinction are, as yet, unclear.

There is some evidence for more selective eating behaviour between active and sedentary individuals; this difference being apparent after adjustments for total food intake. It appears that active individuals pay closer attention to their diet, consuming a somewhat healthier fare then sedentary people. For example, they consume less candies, cookies, cakes and fried foods. The US Department of Health and Human Services (1981), noted that physically active individuals ate less red meat, relative to the sedentary group. The Canada Fitness Survey (1983), found that active subjects were more likely to eat a nutritious protein-containing breakfast (51% vs. 43%), while in the US, Blair, et al. (1987), found active individuals ate more fruit and vegetables, less sugar and less meat than those who were sedentary. However, it must be noted that these differences were all quite small and tended to disappear after controlling for age, gender and SES (Blair, et al., 1982).

Recent evidence from the Campbell's Survey on Well-Being (1990), demonstrated a positive association between good nutrition and an active lifestyle. Adherence to Canada's Food Guide was consistently higher in active individuals of all ages as compared to inactive counterparts. Active individuals were also more likely to limit their fat consumption, compared with their less active age peers. This was especially true for those age 45 and older. Habitual physical activity was not related to salt and sugar intake, however. Finally, inactive individuals were least likely to increase their intake of poultry, fish, fruit and vegetables during the period between 1981 and 1988. These differences were independent of age and education level.

2.2.2 Tobacco Smoking

Several early large-scale surveys in the US and Canada found none, or only weak negative associations between smoking habits and physical activity (US Department of Health, Education and Welfare, 1973, 1977, 1979; Canada's Health Promotion Survey, 1985; Canada Health Survey, 1981). Recent evidence from the Campbell's Survey on Well-Being (1990), however, demonstrated a clear inverse relationship between smoking and physical activity level, which held true for each age group studied (10 years and older). Among youth, the likelihood of never having smoked was directly related to physical activity. Over 80% of Canadians age 10 to 24 who were active have never smoked; which compares with a rate of 64% for their less active age peers.

An inverse relationship was also evident in a study of approximately 1,000 white Zimbabwean men and women who were classified on the basis of leisure-time physical activity (Morrison, et al., 1984). The prevalence of current smoking was 43%, 31%, 22%, 20% and 17% across activity groups from high to low, respectively.

The results of these cross-sectional analyses do not lead to a determination of whether smoking causes low fitness or whether low fitness predisposes one to smoke. It seems logical, however, to assume that smoking is more likely to impair activity performance and perhaps participation. Conversely, those who engage in regular physical activity may be somewhat health conscious and decide not to smoke. It might be expected, therefore, that physical activity might serve as a useful intervention for smoking cessation programs.

The value of physical activity as an intervention technique in smoking cessation was studied by Hill (1985). Smokers (N=36) who enrolled for a smoking cessation program were randomly assigned to either a traditional behaviour modification technique, or to the behavioural intervention plus physical activity for a 5-week period. Cessation rates did not differ significantly after the 5-week intervention, nor at 3- or 6-month follow-ups. The number of cigarettes smoked per day were, however, lower in the physically active group. This observation leads to speculation that activity may act as a useful treatment, but that the statistical power of the study was too low to detect an existing difference between the groups. This speculation, along with the common sense directional relationship between physical activity and smoking, suggest further research with a larger sample size, to ascertain the efficacy of physical activity as a treatment intervention in smoking cessation programs.

2.2.3 Alcohol Consumption

Data relating physical activity and alcohol use are equivocal (Blair, et al., 1985; Blair, et al., 1990). Some studies have shown a relationship between activity or physical fitness and alcohol consumption; others have not. A cross-sectional study of women attending the Cooper Clinic in Dallas noted that individuals in the higher fitness categories consumed less alcohol (Blair, et al., 1984). The same negative relationship was also observed by Kannas (1981), in a study of 880 draft age males in Finland, by Stephens (1985), in the Canada Health Survey, and by Zunich & Dickenson (1979), in male and female joggers.

Conversely, data from the US National Survey of Personal Health Practices and Consequences, and the Behaviour Risk Factor Survey (Blair, et al., 1985), have found little relationship between low alcohol consumption and activity patterns. A weak, but positive relationship has been found between regular physical activity and alcohol consumption in men, while the relationship appeared somewhat stronger in women (Berkman & Breslow, 1983; Folsom, et al., 1985; Pope, 1982). Clearly, involvement in physical activity can create thirst; and many sports groups, in particular, have a tradition of post-game celebrations or post-mortems at the local watering hole!

Some investigators have used physical activity as an intervention in the treatment of alcoholism. Sinyor, et al. (1983), found that exercisers had significantly higher abstinence rates following 3-months of treatment than did non-active controls. Approximately two-thirds of the active group were abstinent as compared to one-third of the control group.

A more recent investigation by Murphy, et al. (1986), described the results of physical activity intervention on heavy drinking in a group of male college students. Sixty men, who consumed at least 45 drinks per month, were randomly assigned to either an exercise, meditation or control group. Both exercise and meditation groups met three times per week to carry out their respective treatments. The exercise group reduced their alcohol consumption during the 8-week treatment period, and a 16-week follow-up. The meditation group was intermediary to the exercise and control groups during the treatment period, but was no different to the control group at the 16-week follow-up. The authors concluded that regular vigorous physical activity is associated with lower levels of alcohol consumption, and that physical activity may prove useful as a treatment in alcoholism, though further research is warranted.

2.2.4 Other Lifestyle Behaviours

Individual health-related behaviours occur mainly in combination, resulting in lifestyle patterns that ultimately impact upon health status. In 1965, a sample of 6,928 non-institutionalized adults in Alameda County, California, were surveyed to determine their current health practices and health status (Breslow, 1972). They were resurveyed in 1974 and have remained under constant surveillance with respect to mortality. Physical health at baseline was associated with seven beneficial habits, of which one was regular physical activity (Belloc & Breslow, 1972). Mortality was lower over a 9.5 year follow-up period in individuals reporting more beneficial health practices at baseline (Breslow & Enstrom, 1980). The authors attempted to weigh precisely each of the seven practices in terms of their impact on mortality. While this proved to be impossible, they did conclude that the habits seemed to be equally important. Physical activity was thus judged to be as important as not smoking, as using alcohol moderately or not at all, as getting 7 to 8 hour of sleep each night, as maintaining proper body weight, as eating breakfast, and as not eating between meals. Efforts to track these seven practices over time revealed a decline in smoking between 1977 and 1983, but results from the other health practices were equivocal (Schoenborn, et al., 1986).

Blair, et al. (1986), compared 2,600 experimental with 1,700 control employees at the Johnson & Johnson Company over a 2-year period in an activity-centred lifestyle intervention program. Fitness levels, as measured by maximal oxygen uptake, increased by an average of 10.5% in the active subjects. At the same time, health attitudes and health knowledge were improved, cigarette and alcohol consumption were reduced, and the active subjects reported an improvement in general well-being (Blair, et al., 1986; Shipley, et al., 1988).

Shephard, et al. (1982), administered the Canadian Health Hazard Appraisal to employees at the Canada Life Assurance Company upon recruitment to the employee fitness and lifestyle program, and six months later. At the time of recruitment, the Canada Life group were somewhat health conscious, with an initial "health age" that was below their calendar age (an advantage of 1.8 years in males and 3.1 years in females). After six months of participation in the fitness and lifestyle program, the gap between "health age" and calendar age had widened, showing general health practice improvements in both men and women (an advantage of 2.6 years in males and 3.5 years in females). Moreover, this development was most noticeable among the strongest program adherents. It reflected a decrease in alcohol consumption, a decrease in cigarette smoking, and a decrease in systolic blood pressure.

The recent Campbell's Survey on Well-Being (1990), was conducted as a follow-up to the 1981 Canada Fitness Survey. It was intended to provide an update to the 1981 information, examine the contribution of physical activity to health, and investigate adherence over time to a regular activity routine. The data gathered in the survey are of value in describing health-related lifestyle patterns in relation to physical activity, for the general population of Canada for the period 1981 to 1988.

In general, the Canadian population age 15 and older was more active in 1988 than in 1981, whether defined by total energy expenditure or simply by time engaged in physical recreation. The percentage of people reporting an energy expenditure in excess of 3 Kcal/kg/day rose from 24% in 1981 to 31% in 1988. More impressive was a 22% increase from 57% to 79% during the same period for people who reported 3 or more hours of recreational activity per week for at least 9 months of the year. As previously discussed, physically active individuals were more likely to display healthier nutritional habits than their sedentary counterparts, and more likely to be non-smokers or quitters. Evidence from the Campbell's Survey (1990), also suggests, that while the differences are still small (range 5% to 9%), active Canadians watch less television; consult their physician less often, are absent from work or school less often, and are at a lower health risk due to obesity. The goal of the Canadian Summit on Fitness (1986), to have physical activity recognized as a Canadian cultural trademark by the year 2000 may well be realized if current trends continue!

2.2.5 Self-Rated Health Status

Self-rated health status is the broadest and most subjective health status indicator, and is widely used in survey research. Until recently, the use of this single self-report indicator to assess health status and subsequent longevity was widely questioned.

Idler, et al. (1991), reported on a study of 2,800 men and women 65 years and older, which showed that those who reported their health as "poor" were seven times more likely to die within the following 12 years than those who reported their health as "excellent". The results of this initial investigation are supported by a review of five other large studies, all of which asked individuals to rate their own health status (Idler, et al., in press). The studies involved more than 23,000 people between age 16 and 94. In all of the studies the response to self-rated health status was found to be a strong predictor of health and longevity as much as 17 years later. She concluded that individual assessment of health status was a stronger predictor of long-term mortality than were physical medical examinations.

At present, the reasons for the apparent advantage of personal assessment over physical examinations in predicting long-term mortality are unclear. One possibility is that a personal rating of current health status is multi-factorial in nature. The individual takes into account many factors such as the health history of relatives, the life span of their parents and grand parents, and the full array of their own lifestyle behaviours. As such, the response to health status is more a prediction of life expectancy than an assessment of current health.

A second view is that a person's beliefs about how healthy they are become self-fulfilling prophecies, leading them to act in ways that cause their assessment to come true. Still a third view posits that self-rated health status reflects a general vulnerability to illness; the leading factor behind such an assessment is a person's level of vitality and energy.

It has been previously reported that regular participation in physical activity leads to several perceived benefits, one of which is a feeling of increased levels of vitality and energy (Shephard, 1988). It would follow, therefore, that as physical activity increases the feeling of vitality and energy, self-reported health status would also improve. In turn, as self-reported health improves, so does longevity. In this sense, physical activity has a key role to play in improving health and longevity.

In the Campbell's Survey on Well-Being (1990), almost one-quarter of Canadians rated overall health as "very good" (the highest category) in 1988. There was a linear relationship between self-reported health status and recreational activity. Highly active Canadians rated their health higher than moderately active, who in turn rated their health higher than the less active group. This relationship was true for all age groups studied.

2.2.6 Conclusions

There appears to be a number of mechanisms whereby regular participation in physical activity might have a beneficial influence on other health-related behaviours. However, part of the observed association between an active lifestyle and other positive health habits may reflect a mutual dependence on education and SES (Blair, et al., 1985). Moreover, with the exception of dietary practices and cigarette smoking, the relationship of an active lifestyle to other positive health habits are somewhat weak, and sometimes equivocal. These weak associations, however, may result from difficulties asscciated with the accurate measurement of physical activity and other health behaviours.

In general, there is some encouragement for the promoters of physical activity as an agent of lifestyle change. Evidence from population trends (Campbell's Survey on Well-Being, 1990), and from multifaceted workplace fitness and lifestyle programs centred around physical activity suggest positive changes in other health-related lifestyle behaviours in high activity adherents. We may therefore conclude that physical activity will remain an appropriate focal point for health promotion efforts in the future. It is likely, however, that they will continue a multifaceted approach that targets other health risks and habits. Future research that is able to measure physical activity, and other health-related behaviours with greater precision will elucidate the role of physical activity in promoting and improving health and longevity.

2.3 OCCUPATIONAL HEALTH: A HISTORICAL PERSPECTIVE

2.3.1 Introduction

Modern workplace programs, referred to by a variety of titles; employee wellness, health enhancement, risk reduction, and fitness and lifestyle, evolved from a variety of programs introduced into workplaces throughout the late 19th and early 20th centuries. Industrial hygiene, health education, health screening, employee assistance and fitness programs are the elements of today's comprehensive workplace programs. A brief historical review helps to elucidate the factors that have either retarded or accelerated developments (Sigerist, 1943). There are four that have had a positive effect on occupational health: I) the economic need to protect the efficiency of the workforce; ii) changing attitudes of workers towards health and safety; iii) increasing competence of health and safety professionals; and, iv) compassion and a sense of caring for others. Not only governments and industries, but also individual workplaces have been influenced by these factors to take more effective action in hazard control and health promotion.

2.3.2 Antiquity to the 20th Century

Although the current workplace fitness and lifestyle movement formally had its beginnings in the mid-1970's, its roots may date back as far as Hippocrates himself (Grossman, 1983). When he and his medical students encountered an unfamiliar city, he would advise his students to become acquainted with the lifestyles of the local residents by noting their work patterns and eating habits.

The first observations on miners and their diseases was made by Agricola (1494-1555), and Paracelsus (1493-1541), in the 16th century. Mortality rate must have been high, judging by the evidence of Agricola's statement that "in the mines of the Carpathian Mountains, women are found to have married seven husbands, all of whom this terrible consumption has carried off to a premature death".

Following the emancipation of the miners from a feudal system in the Middle Ages, mining became a skilled profession. Fueled by a growth of trade and a demand for currency, gold and silver mines were dug deeper, and working conditions worsened. Apart from some improvements in ventilation, miners remained without significant means of protection. However, they organized themselves into societies which provided sickness benefit and funeral expenses, giving them some security and preventing the extremes of social misery (Rosen, 1943).

During the 16th and 17th centuries mining, metal work and other trades flourished in Italy following the Renaissance, which had encouraged the transition from feudalism to capitalism. Paracelsus (1941), observed, "We must have gold and silver, also other metals, iron, tin, copper, lead and mercury. If we wish to have these we must risk both life and body... ". Paracelsus realized that the increasing risk of occupational disease was a necessary and concomitant result of industrial development.

In 1700 Bernardino Ramazzini (1633-1714), physician and professor of medicine published the first systematic study of trade diseases. Rightly acclaimed the father of occupational medicine, he recommended that physicians should firstly enquire about a patient's occupation, and more importantly observe the conditions under which work was completed in order to better understand the etiology of occupational diseases.

Towards the end of the 18th century in England, the manufacture of cotton textiles moved from a cottage industry to a factory system. The factory system spread to other industries in Europe and North America, and this change in the method of manufacture is now known as the Industrial Revolution. Science and technology had made available the use of steam for motive power, and thereby mass production. Further technological inventions entrenched the factory system, and exposed workers of all grades to the pressure of increasing production and associated physical and psychosocial hazards of work.

Inside the factories and mines of the 19th century workers were exposed to hazards of occupational disease and injury and the adverse effects of excessively long working hours. Little attention was paid to safety devices and workers were often not trained to handle the speedy and dangerous machines. Toxic hazards increased as a wider range of new chemicals were introduced without considering the possible effects on the worker. Workers were exposed to the pressure of continuous work at speeds imposed by the needs of production - a pressure which led to many accidents and injuries (Schilling, 1989).

Outside of the factory, the Industrial Revolution had serious effects on the health of the community as a whole. Family life was disrupted as men left to pursue work in the new industrial areas; a situation which encouraged alcoholism and prostitution. Epidemics followed as a result of overcrowding and unsanitary conditions. Malnutrition, unemployment and poverty were results of fluctuations in the economy (Schilling, 1989).

During the 19th century, employers generally believed that it was economically important to keep their machines running continuously with cheap labour. The notable exceptions, however brought pressure to bear through publicizing the adverse working conditions that employees had to endure, and governments were forced to respond. Eventually, the generation of hard-bitten employers gave way to those who were socially more responsible. Working conditions improved steadily, as a result of the collaboration of government, enlightened employers, medical professionals and later unions and paraprofessionals.

2.3.3 Industrial Hygiene Programs

Employers' concern for the health of their employees was influenced by two major developments in the early 1900's: I) labour legislation, particularly the enactment of the workers compensation laws regulating work conditions, and ii) the establishment of professional and governmental agencies and associations related to occupational health and safety.

The first worker's compensation laws were enacted in several countries in the early 1900's. Prior to the enactment of these laws, injured employees suffered financially as well as physically, as they were faced not only with medical expenses, but with loss of income as well. With the introduction of these laws, the burden of the expense related to injuries to workers was placed largely on the employer. At about this time, laws requiring workers to be protected from dangerous equipment was passed, hours of work were shortened, and the physical conditions of the plant were regulated by sanitary codes. This progress was not limited to the city factory, but it extended to the mining and lumber camps, as well as other workplaces (Weinzirl, 1937).

The earliest significant activities to protect and promote the health of industrial workers were concerned primarily with treating industrial injuries. The measures taken to treat and care for injuries ranged from providing first aid treatment to company owned and operated emergency hospitals. Some companies retained a physician for referral while others provided a number of beds at the local hospital free of charge to their employees .

The facilities and services maintained by business and industrial establishments were usually concerned with treating the specific sickness and injury that employees sustained as a result of employment (Schirmer, 1925). For example, oculists were usually maintained for office workers who were likely to strain their eyes, tuberculosis sanatoriums by companies whose shops were likely to cause tuberculosis as a result of excessive fumes or dust, and chiropodists by stores for employees who were on their feet most of the day.

The industrial hygiene programs of the early 1900's have developed into the occupational health and safety programs of today. These programs are due, in large part, to the passage of Occupational Safety and Health Acts. In the US, Congress declared the purpose of the Act "... to assure as far as possible every working man and women in the nation safe and healthful working conditions and to preserve our human resources" (Occupational Safety and Health Act, 1970). With the passage of these Acts, employers were required to provide safe and healthful places and conditions of employment; acquire, maintain and require the use of safety equipment, personal protective equipment, and devices reasonably necessary to protect employees; to keep adequate records of all occupational accidents and illnesses for proper evaluation and necessary corrective action; and to establish employee education/training programs on health and safety hazards and processes (US Department of Labour, 1985).

Workplace health and safety education programs typically address aspects of health promotion, accident prevention, hazard protection, or some combination of these three broad content areas. While laws often specify the content of education programs as well as the audience and the frequency of instruction, methods to achieve workplace-specific learning objects vary greatly depending upon the professional background of the program personnel (Vojtecky, 1987).

2.3.4 Health Education Programs

Introduced primarily to care for industrial injuries and illness, industrial hygiene programs broadened their scope to address health education. Early health education at the workplace was provided by the company physician or nurse, whose primary emphasis was generally on preventive measures. Tolman (1909), described these measures as consisting of monthly lectures on popular health topics and monthly bulletins on sanitary subjects which were circulated free of charge to all employees. Hackett (1925), wrote of the use of radios by railway companies for communicating health information to their employees, and the use of motion pictures by the National Cash Register Company. A form of instruction adopted by many factories was the distribution of health and safety bulletins in pay envelopes (Clark, 1922).

Schirmer (1925), conducted an investigation to determine the extent and types of health education programs offered by business, industry and life insurance companies for their employees and policy holders. He found that, in descending order, the most popular method of health education were lectures and talks by medical department staff, individual consultations by doctors, individual consultations by nurses, pamphlets, home visits by nurses, employee paper or magazine, posters and bulletin boards.

This approach to health education focused on raising awareness and improving knowledge about health concerns. Mass media information dissemination and education tended to be non-personal. Today, health education is viewed as a means of influencing personal health behaviours. The term "health promotion" has come into common use over the past decade, of which health education is a core component. Health promotion seeks to improve or protect health through behavioural, biological, and environmental changes. Education in the areas of weight control, nutrition, stress management, smoking cessation, hypertension control, risk reduction and physical activity and fitness, is offered increasingly at the workplace. These education programs are supported by other activities designed to achieve positive health behaviour, and are further enhanced by company health policies such as smoke-free workplaces, nutritional food choices in cafeterias and vending machines, and flexible working hours to accommodate physical activity during work hours.

2.3.5 Health Screening Programs

The idea of regular medical examinations of apparently healthy individuals for the detection of non-apparent pathological conditions was first put into practice around the turn of the century (Rosen, 1975). At that time, a few businesses began to offer periodic examinations for their employees. In 1909 the medical director of the Provident Savings Life Association organized a free periodic health examination system and an educational service for the company's policy holders. Out of the initial program for policy holders, the Life Extension Institute was founded in 1913. For a $20.00 annual fee, an individual would receive a health examination and be able to participate in all educational activities at the Institute. The growth in the number of businesses offering periodic health examinations was slow until 1922 and 1923 when the Life Extension Institute extended its programs to employees of other business and industrial establishments (Schirmer, 1925).

Employee health examinations served to discover physical defects otherwise unknown to the employee, prevent the spread of infectious disease and lessen epidemics, and to detect diseases in early stages thereby increasing the chances of recovery. Pre-employment examinations were equally important as they were helpful in properly placing prospective employees with impairments in order to minimize the limitation, or at least not aggravate it (Frankel, 1924). And, while opposed by labour unions, physical examinations were sometimes used to exclude high risk applicants, or to discharge those unfit for work. In any case, the physical examination was primarily intended as a means of increasing efficiency and production (Schilling, 1989).

In recent years, health risk or health hazard appraisals have been developed and are being used in addition to, or instead of physical examinations. Further, physical fitness assessments are being conducted, particularly in many large corporations with on-site exercise facilities. The trend in health screening is an attempt to assess the many dimensions of health. For example, in the "Live for Life Program" at Johnson and Johnson, a wide range of health, lifestyle, and attitudinal measures are collected during the health screen. These include biometric (blood lipids, blood pressure, body fat, weight, and estimated maximum oxygen uptake), behavioural (smoking, alcohol use, physical activity, nutrition, job performance and human relations), and attitudinal measures (general well-being, job satisfaction, company perception and health attitudes) (Wilbur, 1985).

2.3.6 Employee Assistance Programs

Employee assistance programs (EAP) trace their roots to industrial counseling programs which focused on the mental health of troubled employees. These programs were originally designed to assist employees with personal problems that interfered with their performance on the job.

One of the earliest counseling and social service programs in a work setting began in 1917 at Northern States Power Company in Minneapolis, Minnesota (Masi, 1982). In 1922 the Metropolitan Life Insurance Company became the first North American business organization to hire a full-time psychiatrist who served in a variety of counseling roles to employees through the medical department, and later the personnel department (McLean, 1985). Macy's Department Store in New York followed suit and established a mental health service for employees staffed by a psychiatrist, a social worker, and a psychologist (McLean, 1985).

Due to the Depression of the 1930's, counseling and mental health services were slow to develop. It wasn't until the 1940's that more companies introduced these programs especially in response to the problem of alcoholism. Trice and Schonbrunn (1981), have summarized the origins and philosophy of workplace alcoholism counseling programs:

> The roots of job-based alcoholism programs can be traced back to the late 19th - early 20th century efforts of employers to eliminate the long-accepted use of alcohol in the workplace. Even though these efforts were largely successful, the process took roughly fifty years, and the repressive measures used created stereotypes that may well have contributed substantially to the stigma surrounding alcoholism. Actual programs came into being in an effort to reduce this stigma and treat the problem drinking employee in a constructive, rehabilitative fashion rather than a punitive one. Programs sprang from the workplace itself and from employers' concerns about job efficiency, worker's compensation, and mechanization... Three forces combined in the late thirties and during the war years to escalate these concerns into embryonic

> programs. These were the rapid rise of Alcoholics Anonymous (AA), the sudden and enlarged need for workers during the war, and the concern of industrial physicians. Persons who were active and highly committed innovators capitalized upon these ingredients during the war, moulding them into specific, but "quiet" programs... The "keep it quiet" theme of the early forties rapidly gave way to more open publicity in the latter part of the decade... By the mid-fifties there were full-blown efforts underway in at least fifty or sixty companies and unions. (pp.194).

The early programs encouraged the use of AA by utilizing the services of recovering alcoholics who worked in the plant. In 1947 the Consolidated Edison Company established an "in-house" program, becoming the first to have top management support. Within two or three years many other companies were also active in developing programs (Trice & Schonbrunn, 1981).

Out of these early efforts emerged what collectively came to be known as occupational alcoholism programs (OAP). By 1950, the number of OAP's grew to about 50 and continued to increase at a fairly steady rate until the 1970's, when the pace began to accelerate sharply (Walsh, 1982). In the 1960's and 1970's, many OAP's expanded to address marital and family, emotional, financial and legal problems, and problems with drugs other than alcohol. This enlarged scope led to the modern EAP's known as the "broad brush" approach to human problems in industry. This became the standard approach, and during the 1970's the number of programs exploded. By 1977 in the US alone, the number of EAP's reached 2,400, up from 500 in 1973 (Walsh, 1982).

The 1980's saw the emergence of thousands of new programs. Many of these programs taking a preventive approach by concentrating on stress management, wellness concepts, and other addiction problems such as smoking, overeating, overworking, etc. Others include services that range from referrals for legal advice, to community social agencies, to physicians and other health professionals, and ongoing counseling for employees and families for a variety of social and emotional concerns (McLean, 1985). These multifaceted EAP's, purport that if stress is controlled and employees are taught healthy lifestyle practices, the problems dealt with by OAP's and more traditional EAP's may well be sufficiently prevented (Dickman, 1988).

2.3.7 Physical Fitness Programs

Contrary to the suggestions of the current literature, workplace exercise facilities and programs are not a recent innovation. The types of activities taking place today are different from those in the past, and the equipment has changed, but employers have long been aware of the benefits of providing employees the opportunity to engage in physical activity. These activities were generally of a recreational nature and oftentimes consisted of team sports.

In his early book, Tolman (1909), described several companies' recreation and leisure activities which consisted of employee outings, company picnics and dances, and various clubs such as gun, camera, and bicycle clubs. Recreation facilities ranged from large parks with swimming pools and roller skating pavilions to athletic fields for baseball and tennis. Tolman described one company's recreational facilities as follows:

> For the purpose of encouraging physical culture through outdoor sports among its employees and their children, the Solvay Process Company has enclosed a five acre plot close to the office building. This model athletic field has a tennis court and running track, and a portion of the space is used for the popular game of baseball... the company has erected a gymnasium on the athletic field where gymnastics classes are held under a competent teacher. The gymnasium is fitted up with all the appliances pertaining to a building of this kind, and is furnished also with a system of shower baths. (pp. 317).

More recently, multifaceted exercise facilities have been constructed at many large corporations, and are being used for health improvement purposes. In an effort to spark interest in the development of more employee fitness programs in the US, the President's Council for Physical Fitness and Sports sponsored the first National Conference on Physical Fitness in Business and Industry in 1972. Top executive from 750 companies were invited to the two-day conference which was conducted to encourage companies to assume a leadership role in providing fitness information and programs to employees. The executives were impressed with the merit of the presentation but were reluctant to take action, stating that they left health decisions to their medical directors (Barnes, 1983). The following year, the Council held a similar conference for medical directors. Their response: "That's great, but we take care of sick people. We're not going to lead people in exercise." (Barnes, 1983).

Frustrated with the response, and recognizing that using other organizations to promote their message was inappropriate, the Council formed its own organization. In 1974 the American Association for Fitness Directors in Business and Industry was founded. This professional association, later renamed the Association for Fitness in Business, and still later, the Association for Worksite Health promotion, marked the formal beginnings of employee fitness as a specialty in the field of occupational health (Barnes, 1983). Membership grew rapidly, as did the number of workplace programs.

In 1974, the National Employee Fitness Conference, held in Toronto, did much to spur interest in Canada. Between 1974 and 1978 various demonstration projects were conducted in an effort to confirm the efficacy of employee fitness programs, and to encourage more employers to sponsor such initiatives. In 1978 the widely cited Canada Life Study was launched. This research project examined the impact of an employee fitness program on individual and organizational outcomes, and was able to demonstrate that program participants improved in measures of fitness, productivity and reduced rates of absenteeism (Cox, et al., 1981).

Through a co-operative effort of Fitness Canada, the Canadian Public Health Association and the Canadian Labour Congress, employee fitness efforts focused on the industrial setting over a three year period ending in 1983. The project successfully demonstrated that with increased physical activity, employees were able counteract stress, contribute to feelings of well-being, as well as generally improve quality of life in the workplace. The program participants were not the only ones to perceive these benefits; management at the participating companies considered the programs so valuable that they continued them at their own expense.

The boom in the oil industry of the 1980's, also saw a massive increase in the number of employee fitness programs. In 1981, Esso Resources opened the Esso Plaza Fitness Centre at their Canadian Resources Division headquarters building in Calgary. This was quickly followed by programs at Petro-Canada, Chevron, Mobil, Texaco, Shell, Gulf, Nova and Dome/Amoco.

In 1985, a co-operative effort of the Canadian Chamber of Commerce and

Fitness Canada launched a series of programs designed to promote employee fitness. These included the preparation and distribution of "Fitness Works", and information piece for employers describing the cost effectiveness of employee fitness programs, cross-Canada seminars, recognition awards for employers, and a survey to determine the prevalence and extent of employee fitness programs in Canada.

Most recently, the development of the Active Living concept has extended to workplace programs. The Canadian Centre for Active Living in the Workplace was established in 1989, and has published, "Working Actively Together: Canada's Blueprint for Action Toward Active Living in the Workplace". This document is a planning framework to guide the development and growth of healthy life choices that include regular physical activity in workplaces across Canada.

2.3.8 Conclusions

Indifference to work health and safety has been a feature of both ancient and modern societies until relatively recent times. Rapid and extensive developments in occupational health began in the early 1900's, and there has been a growing awareness of its importance since then. Workplace health promotion programs are clearly related to the evolution of the concepts of health and disease, and so we have seen a move from single intervention treatment programs, to unidimensional prevention programs, to today's multifaceted efforts that address health from a holistic approach.

The value of health promotion efforts in the workplace in the future will be in the company's continuing efforts to meet the diverse health needs of its employees, and to incorporate health as a fundamental value and corporate strategy, which becomes the normal corporate culture.

2.4 METHODOLOGICAL CONSTRAINTS IN WORKPLACE FITNESS AND LIFESTYLE STUDIES

Reviews of the existing research on workplace fitness and healthy lifestyle promotion programs reveal that most studies are limited in their ability to draw clear inferences about program effects because the studies employed flawed research designs and/or analyses. Conclusions were often drawn about program effectiveness with little consideration given to alternative explanations for the findings (Conrad, et al., 1991).

Several methodological constraints have given rise to these problems and need to be addressed in future studies (Smith & Everly, 1988). These methodological constraints include: I) the inability to employ true experimental designs and the resultant contamination of the subject selection/assignment procedure; ii) data availability constraints (and the associated research design implications); iii) vulnerability to natural maturation processes; and, iv) susceptibility to the Hawthorne Effect.

The voluntary nature of most workplace fitness and lifestyle interventions precludes evaluators from selecting true experimental designs in which participants and control subjects are randomly selected and/or assigned. This, in turn, usually limits the amount of control that evaluators have over the factors that affect the internal validity of results (Conrad, et al., 1991). Rather, quasi-experimental designs are necessitated, calling into question the researcher's ability to rule out all plausible alternative hypotheses for measured changes in key variables.

Some threats to validity will act to increase the likelihood of finding a program effect while others will decrease the likelihood. Thus, validity threats can result in the researcher erroneously concluding that a treatment effect existed when it did not, or that no effect occurred when in actuality the treatment did produce a positive effect, but it was obliterated due to the operation of a validity threat(s). Conrad, et al. (1991), using the Cook & Campbell (1986), delineation of threats to valid causal inference, have discussed 13 threats to internal validity that may be in operation in workplace fitness and lifestyle program research. As it is unlikely that all 13 threats will be operational in any one study, the researcher needs to consider only those threats that seem plausible, not merely possible. The limitations of quasi-experimental designs should not dissuade researchers from their use, however. Through design adjustments or statistical procedures, specific rival hypotheses can be rendered implausible.

Data availability constraints appear endemic in workplace fitness and lifestyle settings. Such constraints, in turn, limit the rigor of the research models that may be employed to examine program success. For example, the ability to conduct longitudinal studies of the impact of workplace fitness and lifestyle programs may be severely compromised by high drop out rates, or by employment turnover, or by changes in level of adherence to the program. High subject mortality may limit the investigation to trend analyses.

Maturation processes refer to the behavioral, physiological, social, etc... changes that occur naturally to participants over the evaluation period (Conrad, et al., 1991). In an evaluation setting where a valid control or comparison group cannot be established and monitored, this threat to internal validity of measured results is present and difficult to control.

The Hawthorne Effect (i.e. placebo effect), refers to the potential for some form of intervention other than the intended program regimen to influence success of participants in the program. To illustrate, in most workplace fitness and lifestyle programs, participants are required to undergo a health screening prior to participation in the intervention program. The screening itself may motivate participant behaviours, attitudes, and physiological changes that would have occurred, to some, albeit unknown, extent, in lieu of program participation. The Hawthorne Effect is mitigated if control/comparison group subjects also receive the health screening.

2.4.1 Summary

A definitive cause and effect relationship between physical activity participation and CHD, other chronic diseases, lifestyle behaviours and health status, has not yet been established. There is, however, strong correlational data linking inactivity to increased mortality from CHD and other chronic diseases, and with decreased lifestyle and overall health.

During the past decade workplace fitness and lifestyle programs have undergone vast growth. These programs have been developed primarily to improve the health of employees and contribute to the effectiveness of the organization by improving productivity through reductions in illness absenteeism and employee turnover (Howard & Mikalachki, 1977; Shephard, 1986).

Workplace fitness and lifestyle programs are currently being extensively evaluated. In particular, the emphasis of this evaluation has been on the impact of such programs on fitness and health knowledge, behaviour and status. These issues are central to demonstrating the value of workplace programs to organizations and potential participants. However, limitations in previous research reduce the ability to draw firm conclusions. The need for research based upon sound theoretical models is imperative for the growth and development of this field of study.

2.5 PHYSICAL ACTIVITY AND ABSENTEEISM

2.5.1 Introduction

Absenteeism is currently one of the most serious problems facing industry in North America. This parameter has been defined by industry in various ways, and the related literature is sometimes confusing. Generally, absence is defined in four ways: I) the number of times absent (frequency); ii) the total number of days or hours absent (severity); iii) the frequency of one day absences (attitudinal); and, iv) absences that are 3 days or more in duration (medical).

In Canada, the primary cause of absenteeism is reported to be attitudinal absence, which occurs 2.5 times more frequently than non-occupational accident; the second cause (Gibson, et al., 1975). In 1977, 80% of all absence in Canada was reportedly due to illness, with the remaining 20% unaccounted for. In addition, 50% of the total amount of sick time taken occurred in 1-3 day periods (Industrial Relations Centre Report, 1975).

Several variables have been studied to determine a possible link to absenteeism. Five early studies which looked at the relationship between age and absenteeism yielded inconclusive results. One study showed that younger and older workers demonstrated higher rates of absenteeism than middle-aged workers (Jackson, 1944), while two separate studies reported a positive relationship between age and absenteeism (Cooper & Payne, 1965; de la Mare & Sergean, 1961). Finally, research by Naylor and Vincent (1959), and Schenet (1945), showed no relationship between age and absenteeism. More recent evidence (Baun, et al., 1986) suggested that illness absence was inversely related to advancing age in both participants and non-participants in an employee fitness program.

Pocock (1973), examined the relationship between sickness absenteeism and length of service in British males and found those with long service (more than 10 years) were absent less frequently than those with shorter tenures. However, conflicting results have been found relating to tenure and absenteeism (Muchinsky, 1977).

Overall job satisfaction has been found to be inversely related to absenteeism (Muchinsky, 1977). In considering other parameters, absence rates are clearly higher in blue-collar versus white-collar workers, females versus males, and non-managers versus managers (Industrial Relations Centre Report, 1975).

Several researchers have looked at absenteeism as it related to lost productivity in industry. The monetary effect of absenteeism is astounding. Direct costs to be considered include a decrease in productivity when the absent worker's job is left undone or if a less experienced worker fills in. Indirect costs also contribute to the total loss. These include the cost of employee benefits, the cost of the excess work force carried in anticipation of absenteeism, and the cost of the staff needed to plan for and manage absenteeism. These costs reach far beyond the worker who is absent from his job.

A consistent inverse relationship has been shown to exist between level of physical activity and risk factors for CHD (Cooper, et al., 1976). Logically then, it might be hypothesized that physical activity programs at the workplace might lead to a reduction in absenteeism due to CHD. Few people, however, call in sick due to CHD. However, according to Dugger & Swengros (1969), next to the common cold, back ailments are the most frequent cause of absenteeism from work. Employee fitness and lifestyle programs which address the need for increased abdominal strength and low-back flexibility certainly have the potential of impacting lost worktime due to back ailments, because, as Kraus & Raab (1961), have pointed out, 80 percent of low back pain is due to muscular deficiencies which can be corrected with physical activity.

Kellett, et al. (1991), evaluated the effect of a weekly exercise program on short-term sick leave (< 50 days) attributable to back pain and determined whether changes in absenteeism were related to cardiovascular fitness. Subjects were randomly assigned to exercise and control groups, sick leave was determined for the 1.5 year intervention period as well as a comparable 1.5 year period prior to the study. In the exercise group, the number of episodes of back pain and the number of sick leave days attributable to back pain decreased by over 50%, while sick days increased in the control group. There were, however, no changes in the cardiovascular fitness of the exercise group.

2.5.2 Cardiovascular Fitness and Absenteeism

The relationship between cardiovascular fitness and absenteeism is equivocal.

Linden (1969), examined the correlation in customs officers, firemen, and office workers. Fitness was assessed using a bicycle ergometer test, and the frequency of absence for the previous five years were calculated. A significant negative relationship between fitness and absenteeism was found to be present only in customs officers. No relationship was reported in firemen or office workers, although in all groups, those with the highest rates of absenteeism had the lowest predicted maximal oxygen uptake.

Bowne, et al., (1984), studied 184 insurance company employees over a five-year period. The majority of the employees held sedentary desk jobs, were female, and ranged in age from 20 to 39. Entry into the fitness program was determined by self-selection. During the program, cardiovascular fitness improved in participants. The proportion in the "good" and "high" categories increased from 16.9% to 39.1%, while those scoring "fair" and "low" decreased from 56.2% to 33.7%. Over the five-year study period, an inverse relationship was documented between level of cardiovascular fitness and absence; i.e. those with a higher level of cardiovascular fitness averaged fewer sick days.

In determining the relationship between cardiovascular fitness (as determined by a sub-maximal treadmill test) and absenteeism in police officers in Austin, Texas, Steinhardt, et al. (1991), found increased levels of fitness were inversely related to absenteeism in male officers, but not in females. In another study of police officers, Boyce, et al. (1991), found physical fitness measures to be poor predictors of absenteeism, explaining only 5% to 7% of the variance in absenteeism when combined with age and sex. The authors concluded that the extent to which physical fitness measures can predict absenteeism is low. They recommend further research that includes many more health and fitness related predictor variables.

Cox & Montgomery (1991), studied the relationship between cardiovascular fitness and absenteeism in hospital workers. They found that while physical fitness was negatively associated with age, it did not correlate with illness absenteeism. As in the studies with police officers, the authors called for multivariate analyses which included a variety of fitness and health predictors.

Finally, Tucker, et al. (1990), determined the extent of the relationship between cardiovascular fitness and absenteeism in 8,301 employed adults. Absenteeism due to illness, demographic variables, and smoking status were assessed by questionnaire, while cardiovascular fitness was determined using a step test. Results indicated that high levels of cardiovascular fitness were associated significantly with low levels of absenteeism. The relationship remained strong after adjusting for differences in age, gender, income, cigarette smoking, and body fat. The association was stronger in females than in males. The non-experimental design of the study precludes conclusions regarding causality. The authors call for longitudinal research to further clarify the connection.

2.5.3 Fitness Program Participation and Absenteeism

Various studies have examined the relationship between participation in workplace fitness programs and rates of absenteeism. In Sweden, absenteeism at a Goodyear tyre plant decreased by 50% following the introduction of an employee fitness program (Keelor, 1976). In the USSR, several studies by Pravosudov (1978), have reported that the duration of sick leave is lower in workers who exercise. In addition, those who are not physically active are ill five to eight times more often than those who do exercise. The same research concluded physically inactive workers consulted physicians four times more frequently than active people, and that only 22.5% of the consultations of active people resulted in absence from work, whereas consultation by unfit workers resulted in absence 60% of the time. Similarly, Northern Gas Company reported that significantly fewer days were lost due to illness in the participants of an aerobic program, as compared to non-participants, and employees in a 12-week exercise program had less absenteeism during the program than they did prior to its initiation (Chenoweth, 1983).

Mealy (1979), examined the effects of an exercise program on police officers in the Dallas Police Department. The six-month program resulted in a 29% decrease to 1.5 days/month for the exercise group, while the comparison group increased absence by 5% to 2.2 days/month. In a more recent study in Austin, Texas, Steinhardt, et al. (1991), assessed the relationship of participation in physical activity to rates of absenteeism in 734 police officers. They found that non-participant officers were absent significantly more often than active officers.

In 1978, Bjurstrom & Alexiou presented a 5-year report on the New York State

Heart Disease Intervention Program for public employees. The experience of that program, involving 847 workers, resulted not only in favourable modification of risk factors and amelioration of health problems, but also reduction in absenteeism. Specifically, the mean absenteeism charged to illness for program participants was 46.5 hours during the primary intervention year. This contrasted with an average 73.5 hour of sick leave reported for all New York State employees for the same year. Within the participants, a net reduction of 4.7 hours per employee per year was reported when sick leave for the year preceding the program was compared with that of the first program year.

In a study involving public employees at a small branch of the Federal Highway Administration, Horowitz (1987), reported a significant decrease in absenteeism among wellness program participants. Following the first year of the program, annual absenteeism rates had decreased by an average of 14.7 hours (26.4%) among participants, when compared to the annual pre-program absenteeism rate.

In a study of provincial government employees in Canada, significant reductions in rates of absenteeism were found in fitness and lifestyle program participants, as compared to controls following a five-month pilot program. Participants demonstrated an average 1.75 days absent during the program period as compared to 3.25 days absent for the same five-month period one year earlier. This compared to the control group who demonstrated an average 2.5 days absent during the program period and 2.4 days absent for the same period one year earlier (Pike, et al., 1989).

In private industry, Sky Brothers, Inc., began a fitness program for their employees in 1980 that resulted in a 6% decrease in absenteeism after only 10 months (Behrens, 1986). Bowne, et al. (1984), reported that the number of disability days declined by 20% for participants in the Prudential workplace fitness program after just 1 year; 54.1% lower than the company average (3.35 days vs. 7.3 days). Meanwhile, non-participant cohorts continued at a plateau level that had been observed over the previous five-year period. This amounted to 42.6% more days of disability compared to the fitness program participants before the program began. In the same report, Bowne and his associates reported that in a preliminary investigation to their 5-year study, they had noted an inverse relationship between disability absences and the level of an employee's cardiorespiratory fitness; that is, the more fit employees had fewer disability days.

An exercise and health promotion program in the Dallas school system attracted 4,000 teachers as participants. This group averaged 5.3 days/year absent after one year of participation, compared to 8.5 days the previous year (Association for Fitness in Business, 1985). Other corporations are also realizing the benefits of the corporate investment in employee fitness programs. Control Data's Staywell Program concluded that of the employees absent more than 5 days/year due to illness, 15% exercised and had other low risk behaviour, while 18% were classified as high risk (Spenser & Associates, 1987). At the Johnson & Johnson Corporation, those employees who exhibited higher fitness levels were absent 9.3 hours/year, while unfit employees averaged 20.3 hours/year absent (Bly, et al.,1986).

Pender, et al. (1987), studied the monthly illness absence rates for 30 fitness centre members and 86 non-members at the Signature Corporation during a 10-month period. Repeated measures analysis of variance revealed a significant difference between members and non-members on rates of absenteeism. Absenteeism was lower for members for all ten months, and pairwise comparisons indicated significant differences for all but months six and nine. White (1988), reported a significant difference in rates of illness absenteeism between male participants and controls age 50 to 59 in a large industry in the Midwest. The participants were selected by program staff on the basis of their regular attendance, while the controls were randomly selected from company computer records.

Bell & Blanke (1989), studied the initial effects of a workplace fitness program on employee absenteeism during the first eight-months of operation of a corporate fitness centre. One hundred, eight (108) male and female participants were compared to an equal number of non-participants. They found no differences in rates of absenteeism over the first 8-months of program participation, contrary to results reported by Gettman (1986), and Cox (1981), who both reported reduced absenteeism in program participants following the first year of fitness program implementation.

The landmark Canada Life Study, initiated by Shephard, et al. (1977-78), and followed for several years by other researchers (Cox, et al., 1981; Shephard, et al., 1981, 1982a, 1982b, 1983; Song, et al., 1983), documented the effects of an exercise program on office workers at the Canada Life Assurance Company and compared them to employees at the North American Life Assurance Company. Cox, et al. (1981), found that six-months after the introduction of a fitness class for employees, absenteeism in high adherents was reduced by 22% relative to that seen in other employees. Through statistical analysis, it was determined that the employee fitness program decreased absenteeism independent of self-selection effects, since the high adherents had the same initial absence rates as other company employees. Although a 22% decrease is a substantial reduction, the amount was reduced somewhat due to a decrease in absenteeism in the remaining employees at the test and control companies during the intervention period.

In comparing the test year to the previous year, 12% of employees who were categorized as high adherents exhibited a 42% decrease in absenteeism, compared to a 20% decrease in the other participants. Whatever the mechanism contributing to the overall decrease in absenteeism as a result of fitness program participation, high adherents to exercise clearly exhibited a large effect.

Further evidence for a possible cause-and-effect relationship was obtained when the survey of absenteeism was extended for an additional year. After 18-months, the group was re-evaluated, with overall participation reported to be 17.2%. At this point, individual behaviour had changed substantially. Former high adherents had become low adherents and dropouts had become high adherents. When absenteeism was reviewed in terms of the original classification, no difference was found between high and low adherents. However, when the subjects were reclassified according to current activity level, a reduction in absenteeism relative to program participation was again apparent. Over the 18-month period, absenteeism was reduced in the exercisers by 1.6 days/worker/year.

Several mechanisms for the change in absence have been explored by the authors. It was suggested that the changes observed in high adherents resulted from self-selection, rather than from a true response to program participation. According to the authors, however, this was unlikely since the absenteeism of the high adherents did not differ from that of other employees in the year prior to introducing the fitness program. From informal discussions with employees, Shephard, et al. (1981), speculated that the fitness program may have had a beneficial effect upon non-participant absenteeism through a "Hawthorne Effect" and a general increase in company morale. In addition, activity and absenteeism were also hypothesized to be connected through other pathways. Firstly, absence from work would have made it difficult to attend two to three fitness classes per week. Secondly, enjoyment of fitness classes encouraged work attendance. Finally, it was theorized that over a long time span, exercise will improve physical condition and work performance. The researchers clearly point out that all of these factors are probable contributors to work attendance, although it is difficult, if not impossible to separate the effects of an exercise program from a more general change in work environment.

Research at Tenneco headquarters in Houston (Baun, et al., 1986), observed absenteeism rates of exercisers and non-exercisers after the first operational year of a health and fitness program. The data collected revealed a decrease in absenteeism among female exercisers, that illness absence was inversely related to advancing age among all exercisers, and that absence rates during the first year of the program increased in non-exercisers. Female exercisers averaged 47 hours of sick time while non-exercisers averaged 69 hours. Overall, a one-day difference in absence per worker year was found between exercisers and non-exercisers for all employees.

However, upon reviewing records for prior years, it was discovered that the absenteeism rates prior to and after the opening of the fitness facility remained approximately the same for the exercisers and non-exercisers; this suggests that the difference between the two groups is more related to self-selection and the personality traits of successful exercisers than to the beneficial effects of exercise itself.

Another study conducted at Mesa Petroleum Company reviewed absenteeism rates following participation in a company-sponsored fitness program (Gettman, 1986). Approximately 60% of all employees were active in the program during the research period. After the two-year study ended, Gettman (1986), concluded that an inverse relationship exists between activity level and absenteeism. Those employees expending 0-10 Kcal/kg/week averaged 35 hours of absence per year, while their more active counterparts who expended 30-90 Kcal/kg/week averaged only 14 hours of absence per year. Employees who were sedentary during both years of the study averaged 41 hours of sick time per year. Those who were sedentary during the first study year but active the second, decreased their average hours absent from 36 to 20 per year. Conversely, those who were active the first year but sedentary the second, increased absenteeism from 42 to 54 hours. Although participants were self-selected into the program, these findings tend to negate the confounding problem.

Overall, analysis of the data revealed a significant difference of 12-hours (29 vs. 41) in the first year, and 21-hours (20 vs. 41) in the second, between exercisers and non-exercisers. In addition, data from 338 employees active during both years of the program disclosed a significant decrease in absenteeism from 28 hours during the first year to 21 hours during the second program year.

In sub-group analysis, Gettman (1986), concluded that there was no significant difference in absenteeism between female exercisers and non-exercisers, but that the difference in absence between exercising and non-exercising males was significant, contradicting the research of Baun, et al., (1986). In agreement with previous research, managers were found to take less sick time than non-managers.

Although studies relating physical activity to absenteeism have been quite detailed, few have observed the effects of physical activity on absenteeism past one or two years. While the results are equivocal, the extent to which absenteeism may decrease over this short time span is often attributed to a general improvement in work environment rather than to the specific effects of physical activity itself. Bowne, et al., (1984), studied 184 insurance company employees over a five-year period. The majority of the employees held sedentary desk jobs, were female, and ranged in age from 20 to 39. Entry into the fitness program was determined by self-selection.

The entire population showed a stable sick day pattern over the five-year period, ranging from 6.75 to 7.7 days/worker/year. After one-year of participation, exercisers averaged 3.35 days absent per worker year, a 20.1% decrease from their average one-year rates prior to program entry. Participants in the program initially averaged 42.6% fewer sick days than the home office average. This increased to 54.1% fewer absent days after one year of participation in the fitness program.

One group of researchers set out to identify multiple fitness factors that contribute to employee absence and to derive a predictive equation utilizing those factors (Hunter, et al., 1987). Their results indicated that percent body fat predicted from skinfold measurements, job status (but not job satisfaction), and resting heart rate were significant factors in predicting sick leave. Although aerobic capacity and estimates of caloric expenditure were not significant, because resting heart rate and body fat are two physiologic measures of fitness, the authors suggested that their findings may imply a link between fitness and sick leave.

2.5.4 Conclusions

While the findings from these studies are quite positive, a number of considerations need to be addressed. Many of the studies supporting a reduction in absenteeism based on habitual physical activity participation, did not examine certain baseline data on their participants, the issue of self-selection, or the absence of controls (Donoghue, 1977; Haskell, 1980). It is quite possible that variables other than deliberate participation in physical activities could significantly influence employee absenteeism. Variation in absenteeism may be a function of other lifestyle and health factors or sociodemographic variables (Colligan, 1980; Smith 1979; Steers, 1978).

Steers and Rhodes (1978), in proposing a process model of absenteeism, emphasized the need for multivariate analysis techniques. Previous research has demonstrated a number of other variables affecting absenteeism and turnover, including: age, gender, educational level, marital status, number of dependents, occupational level, health status, sick leave availability, income, and length of service.

Demographic variables have also been examined in relation to absenteeism. The data are, however, inconsistent. Income and gender have been found to be associated with absenteeism (Steers, 1978). Both high and low incomes have been tied to greater absenteeism. Women are more often absent from their jobs than are men. Few definitive conclusions can be drawn unless variables are examined simultaneously in any study which focuses on absenteeism as an outcome.

Given the lack of controlled randomized designs of most of the studies, there are a number of possible explanations for the inverse relationship between physical activity program participation and/or fitness, and absenteeism. Firstly, frequent absenteeism may cause reduced participation/fitness. Secondly, participation/fitness and absenteeism may be caused by other common factors; or thirdly, participation/fitness may actually cause reduced absenteeism in employed adults.

The first explanation relates to the directional problem. Because of the non-experimental design of most studies, it is difficult to determine whether participation/fitness influences absenteeism or vice versa. It is more plausible that a "third variable" influences the association, since participation/fitness and absenteeism are both affected by common health-related factors. For example, family history of chronic illness could lead to reduced participation/fitness levels and increased absenteeism due to illness. Similarly, over-nutrition or obesity could affect cardiovascular fitness/participation and absenteeism.

Perhaps the most plausible argument is that participation and favourable levels of fitness actually reduce absenteeism, since both physical activity and increased cardiovascular fitness lead to improved health, and healthier employees are less likely to be absent due to illness.

The incidence of absenteeism among fitness program participants and non-participants has been explored in a number of studies. Few attempts have been made to investigate differences between participants and non-participants in terms of multiple variables, and no study yet, to the knowledge of this author, has attempted to include multiple variables related to workplace fitness and lifestyle program attendance, physical fitness, lifestyle behaviours and health status as predictors of illness absenteeism in a longitudinal design.

3. METHODS AND MEASURES

This investigation was designed, through a series of three related studies, to examine the long term impact of an employee fitness and lifestyle program upon, physical fitness, lifestyle behaviours, health status, and rates of illness absenteeism. The first two studies were evaluative in nature, while the third study was designed to examine the fitness, lifestyle and health-related predictors of illness absenteeism. This chapter will describe the overall methods and measures used in the three studies. Each study design and methodology will then be addressed separately.

3.1 STUDY POPULATION

Data from all employees who were members of the fitness and lifestyle program during the period 1981 to 1990 were included in this investigation. Study 2, which looks at the relationship of physical activity to illness absenteeism, is confined to the period 1986 to 1990. Data pertaining to annual days absent due to illness were unavailable for the period previous to 1986. However, analyses were extended beyond fitness and lifestyle program members to all employees of Esso Resources for that five-year period.

Employees at Esso Resources were generally young and predominantly male. Approximately 50% were under the age of 34, and 65% of the employees were male. Approximately 75% of the company was classified as management (MPT), while the remaining 25% were classified as administration (ADM). The employee fitness and lifestyle program was open to all employees and regular program promotions were implemented on a year-round basis. Using data from 1986 to 1990, approximately 50% of all employees had at least three years of post-secondary education, and had at least six years of service with Esso Resources. Excluding Executives, monthly salaries ranged between $920 and $11,605, with a five-year gross monthly income averaging approximately $4,400. Approximately 60% of all employees were married and 25% had at least one dependent child under the age of six.

Over the ten years of programming, 3,151 employees joined the fitness and lifestyle program. Using data from 1986 to 1990 this represents an average annual membership rate of 34% of the total employee population; somewhat higher than previously reported workplace program participation rates of approximately 20 % (see Shephard, 1991, for a review), but in agreement with the findings of the Campbell's Survey on the well-being of Canadians, who classified approximately one-third of the population as active during leisure time (Stephens & Craig, 1990).

Fitness, lifestyle and health data were available for 3,080 fitness program members, who could be objectively classified into four participation groups: I) non-participants; ii) occasional participants (participation sporadic and inconsistent - monthly to twice per week); iii) regular participants (consistently attending the program on a weekly basis - 3 to 7 times per week); and, iv) dropouts (completed only a pre-entry test).

Approximately 60% of all employees reported no absence from work due to illness. Of the remaining 40%, annual days absent due to illness ranged from 1 to 199 days, with an average of 2.6 days per year. Absenteeism data were available for a total of 1,597 employees who worked at Esso Resources Headquarters between 1986 and 1990.

3.2 THE ESSO PLAZA FITNESS CENTRE PROGRAM

The Esso Plaza Fitness Centre is a 12,500 square foot facility located on the fourth floor of Esso's Resources Canadian Headquarters building in Calgary, Alberta. The facility includes lockers and showers for both males and females. A banked, three-lane running track surrounds an individualized strength training area which includes free weights and a wide variety of isokinetic and isotonic strength training machines. Adjacent to the strength training area is a group exercise room for aerobic classes. On the running track perimeter are individualized exercise areas equipped with mats, rowing machines, cycle ergometers and cross-country skiing ergometers.

The program is offered to all employees at a fee of approximately $15.00 per month, for which payroll deduction is available. The fitness centre provides exercise clothing and a laundry service. Hours of operation are from 6:30 a.m. to 6:30 p.m., Monday through Friday. Programs offered include individual lifestyle counseling, activity prescriptions and group activity classes. Fitness and self-reported health assessments are required prior to the initiation of a program, and are repeated on an annual basis.

3.3 PERSONAL AND DEMOGRAPHIC DATA

Personal and demographic data were available for all employees who worked at Esso Resources Headquarters between 1986 and 1990 from the Human Resources Department, Esso Resources. Included is information regarding: gender, date of birth, job classification, annual days absent due to illness, marital status, number of dependents under age six, years of post-secondary education, work tenure and income. In previous studies, these characteristics have been shown to be related to employee absenteeism and were therefore controlled for in all analyses relating to this dependent variable.

3.4 PHYSICAL FITNESS MEASURES

Physical fitness data were collected at the time of entry to the fitness and lifestyle program, and at yearly intervals while membership was maintained. Employees were instructed to refrain from smoking, eating and exercising for at least 2 hours prior to testing. All physical fitness measurements were made by trained fitness assessors (STFA's and/or CFA's) according to the procedures and guidelines described for the Canadian Standardized Test of Fitness (Fitness Canada, 1986). These measurements included:

3.4.1 Body Composition: Standing height (cm), weight (kg), skinfold (mm) and body girth (cm) measurements were made, and various indices of body composition were estimated. These included Body Mass Index (BMI), sum of five skinfolds (SOS) and waist to hip ratio (WHR).

3.4.2 Muscular Endurance: Muscular endurance was estimated by a test to determine the number of sit-ups completed in 1-minute. This gave an indication of the muscular endurance of the abdominal muscles.

3.4.3 Flexibility: The flexibility of the hips, trunk and lower back was estimated using a sit and reach test. Subjects sat with their legs together extended in front of them. Extending the arms forward and lowering the head towards the knees, the measure of flexibility was taken as the distance (cm) between the toes and the tip of the fingers. Touching the toes was equivalent of a measure of 25 cm.

3.4.4 Predicted VO_2max: The Canadian Aerobic Fitness Test (CAFT) was used to predict maximal oxygen uptake. The CAFT is a two-step, multi-stage step test performed to music. VO_2max is predicted from heart rate response measured immediately at the end of each stepping stage according to the equation developed by Jette, et al. (1976).

3.5 LIFESTYLE BEHAVIOURS AND HEALTH STATUS MEASURES

As part of the entry, and annual fitness assessments, resting heart rate and blood pressure were measured. The employees also completed a questionnaire (Appendix A) related to self-perceptions of lifestyle behaviours and health status which resulted in a total of 33 variables. For the purposes of this investigation, only the variables pertinent to the particular question are included in the analyses, and are discussed in detail in the following chapters. Most of these variables were measured using Likert-type scales.

3.5.1 Occupation: Occupational category was dichotomously categorized as either management (MPT) or Administrative (ADM). Two questions, measured on Likert type scales, asked the respondent to rate: I) the degree of physical activity involved in completing their job (4-point scale; Very active to sedentary); and, ii) the degree to which mental stress is associated with the job (5-point scale; always to never).

3.5.2 Physical Activity: Three questions asked information with respect to current self-rated fitness level, frequency of involvement in physical activity, and the reasons for non-participation, if any. Self-rated fitness level was measured on a 4-point Likert type scale (Excellent to Poor); frequency of physical activity on a 6-point scale (5-7 times/week to Never); and, the reasons for non-participation were checked from a list of five (Lack of interest, facilities, time; ill health, and injury), plus one "other".

3.5.3 Smoking, Alcohol and Caffeine Consumption: In all three cases, respondents were asked to indicate their consumption of tobacco, alcohol and caffeine to a three category answer; Yes, Occasionally, or No. If the answer to either of the questions was Occasionally or Yes, further information was requested detailing the number of cigarettes, cigars and/or pipes smoked per day; the number of drinks (liquor, beer and/or wine) consumed per week; and, the number of cups of coffee and/or tea consumed per day.

3.5.4 Nutrition: Nutritional habits were assessed using five, 5-point scale Likert type questions (Always to Never). The numerical score for each response was summed to give an overall nutritional score ranging from 5 to 25 points, which could be interpreted as the degree of adherence to Canada's Food Guide. Three arbitrary categories, reflecting low (5-15), moderate (16-19), and high (20-25) adherence were created. The higher the score, the more healthy the nutritional practices. The rationale for combining the scores was made on the basis that the coincidental practices of: eating the recommended number of servings from each food group (Canada's Food Guide, 1985); eating regular meals daily; restricting salt and foods high in sugar; and, increasing foods high in polyunsaturated fats, was superior to any one practice by itself.

3.5.5 General Health: Resting heart rate and blood pressure were assessed as per the guidelines for the Canadian Standardized Test of Fitness (Fitness Canada, 1986). Respondents were asked to rate their present state of health (4-point Likert type scale; Excellent to Poor). Two questions asked the respondent to indicate whether they had suffered any major illness or injury, or undergone surgery. If the response to either of these questions was Yes, then the respondent was asked to indicate how long ago the problem occurred, and whether there were any resulting limitations. A Yes answer relating to the presence of any back problems, was further explored by asking whether the respondent had seen a physician, and whether x-rays had been taken of the area concerned. Finally, respondents were asked whether they used medications on a regular basis. Affirmative respondents were asked to give details regarding the name, frequency and dosage of the medication.

3.6 ILLNESS ABSENTEEISM

Unlike many previous studies related to absenteeism, this study is concerned with absence due only to the employee's own illness, and is restricted to company-classified "illness absences". The focus is thus, on what is often referred in the literature to as involuntary absence. This is not entirely adequate, however. Even the most accurate record keeping cannot entirely discriminate between voluntary and involuntary absence. A common cold may be sufficient reason to stay away from work for one employee but not for another. Moreover, some employees are more likely to attribute their absences to illness than are others, and therefore some degree of personal discretion enters any analysis of illness absenteeism. Finally, some employees, because of personal lifestyles and genetic predispositions, are more likely to become ill or injured (Bouchard, 1990). In general then, an employee's health problems, lifestyles and heredity, as well as personal propensity to attend work will all affect absenteeism.

In measuring absenteeism, the variable itself presents some unique methodological concerns. The two most often used measures of absenteeism are frequency and total time-lost. Frequency generally refers to a count of absence spells in a certain period, while total time-lost refers to the amount of time for all spells combined. Hammer and Landau (1981), argue that frequency measures are more stable and less susceptible to skewness and leptokurtosis than are time-lost measures, and are therefore more appropriate in multiple regression analyses which require a normally distributed dependent variable for the purposes of hypothesis testing. However, frequency measures are not as likely to reflect absences due to illness as are time-lost measures. An employee may suffer a severe illness and be absent from work for a period of 20 days. The frequency measure would count this as only one absence while the time-lost measure would record it as 20. If it is desired to measure not only the incidence of poor health, but also achieve some understanding of the severity, then time-lost methods are superior (Smulders, 1983).

In the context of this investigation, time-loss measures of absenteeism are most appropriate. The statistical methods used to analyze this dependent variable will be discussed in detail in the sections pertaining to each study that follow.

4. STUDY 1: THE RELATIONSHIP OF PHYSICAL ACTIVITY TO PHYSICAL FITNESS, LIFESTYLE AND HEALTH

4.1 INTRODUCTION

In recent years, regular physical activity has gained wide acceptance as one component of a healthful lifestyle. As discussed in the Introduction, the interrelationships between physical activity, fitness, lifestyle and health outcomes are, however, complex, and as yet, poorly understood. Bouchard, et al. (1990), have developed a model which represents these interrelationships. Recent evidence from the International Consensus Conference on Physical Activity, Fitness and Health (Toronto, 1992), suggested growing evidence in support of this model.

A better understanding of the relationships between physical activity and other health behaviours is important. If activity can lead to the adoption of other beneficial health habits, physical activity programs can be the centrepiece of health promotion efforts. Coupled with the fact that the workplace provides a good setting to reach large numbers with health promotion information, workplace fitness and lifestyle programs which are centred around physical activity programs may be a cornerstone in changing societal behaviours towards improved health.

Using the model of Bouchard, et al. (1990), as a theoretical framework, this study will attempt to determine the relationship of participation in the fitness and lifestyle program with changes in measures of physical fitness, lifestyle and health status in the long-term.

4.2 PURPOSE OF STUDY 1

To determine if level and length of participation in the workplace fitness and lifestyle program at Esso Resources Headquarters is significantly related to measures of physical fitness, lifestyle behaviour and health status.

4.3 STUDY DESIGN

Employees who entered the workplace fitness and lifestyle program received assessments at the time of entry (pre-test) and annually thereafter (post-test), as long as membership was maintained. Fitness, lifestyle and health data were available for 3,080 fitness program members, who could be objectively classified into four participation groups; I) non-participants (NON); ii) occasional participants (OCC); iii) regular participants (REG); and, iv) dropouts (DROP). Program participants were further classified on the basis of gender, and length of participation in the fitness and lifestyle program regardless of the year of entry to the program (1YR; 2YR; 3YR; 4YR; 5-10YR)

For the purposes of this study, the participation groups were defined in three different ways. In the first analysis, and of key concern, three groups (NON, OCC, REG) were compared. In a second analysis, DROP was grouped with NON and compared to OCC and REG. And in a third, DROP was combined with REG and compared to OCC and NON.

The rationale for these regroupings were that the DROP group did not complete the entire first year of the fitness and lifestyle program. This may have been due to disinterest, illness, personal problems, leaving the company, belief that the re-assessment was unnecessary, pursuit of physical activity outside of the company program, or other factors. In any event, the possibility of the DROP group affecting the results was considered. Combining DROP with NON in one analysis and with REG in another, permitted a greater understanding of how fitness, lifestyle and health was associated with program participation.

Several different questions were addressed in this study. These included questions of differences between participation groups based upon gender, level and length of participation, and the question of changes within each group over time. The differences in measures of fitness, lifestyle and health were estimated by comparing the mean change scores (effect sizes) of the different participation groups following 1 to 10 years of program membership. The use of effect sizes was advantageous in this study for several reasons, which are discussed below.

4.3.1 Effect Size

The use of "effect sizes" for assessing the magnitude and meaning of health status changes has been recommended by Kazis, et al. (1989). Effect sizes have received attention in the social and behavioural sciences literature (Wolf, 1986), but they have been used very little in the medical and fitness fields. An effect size represents a standardized measure of change in a group or a difference in changes between groups, and while there are several approaches to the calculation of an effect size, all involve dividing the mean change in a variable by the standard deviation of that variable (Cohen, 1988).

Effect-size as used in this study, was calculated by taking the difference between the mean scores from the fitness and lifestyle measures at the time of program entry, and the fitness and lifestyle measures one or more years later and dividing it by the standard deviation of the same measure from the initial test. The investigation was interested in the magnitude or size of the change rather than the statistical significance, so we used the standard deviation at the baseline rather than the standard deviation of the difference between the means (Rubinson and Neutens, 1987).

There were two important analytical reasons to use effect-sizes in the context of this study. The first is that the initial test scores are used as a proxy for control group scores and treats the effect-size as a standard measure of change in a "before and after" study context. The second, which is important in non-randomized designs, is that there may be overall differences between the groups at baseline, and the use of effect-sizes can potentially correct for these differences.

Effect sizes can be used to translate changes in fitness, lifestyle and health status into a standard unit of measurement that provided a clearer interpretation of the results. This can be accomplished by using effect sizes as benchmarks for measuring changes within groups, or as a means for making comparisons between the measures of fitness, lifestyle and health, and between cohorts of interest in the same study.

This study utilizes the effect-size approach from four perspectives. The first, as a benchmark to gain an understanding of changes over time in measures of fitness, lifestyle behaviours and health status. Secondly, to enable direct comparisons between objective and self-report measures. Thirdly, effect sizes allow for comparisons between the three participation groups, and finally, as supplements to standard statistical significance tests to give a more complete picture of the meaning of changes in fitness, lifestyle, health status as a consequence of participation in the workplace fitness and lifestyle program.

4.4 DATA ANALYSES

Since subjects were neither randomly selected nor randomly assigned to groups, this study was classified as quasi experimental. A comparison group design utilizing mean change scores was employed. The three dependent variables, fitness, lifestyle behaviours and health status were characterized by multivariate interval, ordinal and categorical measures. In order to gain an understanding of the distribution of the dependent measures among the cohort groups of interest, the Chi-Square-based Coefficient of Contingency was used at pre-test to assess the strength of association between measures of fitness, lifestyle and health, and gender, level and length of program participation. These associations are described in detail in the appropriate sections that follow.

4.4.1 Fitness Data

Health-related fitness was assessed through estimates of its various components. The morphological component included four measures of body composition, the muscular component, three measure of strength and endurance, and the cardiorespiratory component, one measure of predicted maximum oxygen uptake (VO_2max) and a measure of resting blood pressure composed of two component parts (systolic and diastolic). A single measure of hip and lower back flexibility, resulted in eleven measures, all interval in nature.

For the purpose of analyzing health-related fitness changes associated with participation in the fitness and lifestyle program, the following variables were included: I) Morphological factors - Body Mass Index (BMI), Sum of Five Skinfolds (SOS), Waist to hip ratio (WHR); ii) Muscular factor - Number of sit-ups completed in one minute; iii) Flexibility; and, iv) Cardiorespiratory factors - VO_2max and resting diastolic blood pressure.

The ultimate purpose of the workplace fitness and lifestyle program is to improve the health and well-being of employees at Esso. The rationale for the inclusion of variables to assess the impact of the program in this regard, can therefore be defended with this ultimate purpose in mind.

Both very high and very low BMI values are related to high all-cause mortality, and it is commonly accepted that body fat content is the source of the risk associated with a high BMI. Studies also indicate that high levels of body fat mass are significantly associated with health risks and elevated blood pressure (Bouchard & Shephard, in press). Further, the distribution of the fat on the body is also associated with various health risks. The inclusion of the WHR measure reflects a concern for the increased mortality rate in both sexes associated with higher levels of adipose tissue on the trunk and upper body.

Programs that develop increased abdominal strength and low-back flexibility have the potential to reduce and prevent low back pain. The measures of flexibility and muscular endurance (sit-ups) are directly related to this health outcome.

The cardiorespiratory component of fitness has traditionally been regarded as the most important from a health standpoint (Astrand, 1967). Maximal oxygen uptake is a measure of one's endurance capacity, and reflects the ability to perform work for a sustained period. Blood pressure is important because hypertension is one of the "cardinal risk factors" associated with cardiovascular diseases, and increased resting diastolic pressure has been linked with increased risk for coronary heart disease.

Therefore, the health-related fitness variables included in the statistical analyses number seven. Three 3 x 2 x 5 (Group x Gender x Length of membership) MANOVA analyses will be used to analyze the seven health-related fitness measures. The analysis is repeated three times, recombining the program dropouts with non-participants and regular participants, as previously discussed.

4.4.2 Lifestyle Behaviours Data

The variables that reflected lifestyle behaviours, and included in the analyses were all interval in nature. The number of cigarettes, cigars and/or pipes smoked per day were analyzed. Nutrition habits, alcohol and caffeine consumption and frequency of leisure time physical activity are all associated with health, and/or physical fitness (see Chapter 2). The degree to which there are changes in these variables, concomitant to participation in the fitness and lifestyle program will be assessed.

The five lifestyle behaviours measures were analyzed using a series of non-parametric procedures (with the exception of nutrition habits which will be analyzed utilizing a 3 x 2 x 5 ANOVA). Each dependent measure was analyzed in a 3 x 2 x 5 (Group x Gender x Length of Membership) Kruskall-Wallis (1952) one-way analysis of variance by ranks. Each analysis will be repeated three times to evaluate the effect of the program dropouts, as previously discussed.

4.4.3 Health Status Data

Four measures of self-rated health status were assessed for their association with participation in the fitness and lifestyle program; all ordinal in nature. Self-rated overall health status has been shown to be associated with improved health and longevity (Idler, 1991). Similarly, self-rated fitness level and perceived job strain, either physically (work-related physical activity) or emotionally (work-related stress) are also important outcomes to determine.

The four health status measures were analyzed using a series of non-parametric procedures. Each dependent measure was analyzed in a 3 x 2 x 5 (Group x Gender x Length of Membership) Kruskall-Wallis (1952) one-way analysis of variance by ranks. Each analysis was repeated three times to evaluate the effect of the program dropouts, as previously discussed. In addition, data on medical conditions were available, including incidence of chronic back problems, recency of illness or surgery and the use of medications. These medical data were analyzed by determining the strengths of associations with participation in the fitness and lifestyle program.

4.5 RESULTS

The purpose of Study 1 was to determine if level and length of participation in the workplace fitness and lifestyle program at Esso Resources Headquarters was significantly related to measures of physical fitness, lifestyle behaviour and health status.

4.5.1 Pre-test and Post-test Data

Included in this study were 1,266 female and 1,814 male employees who were members of the workplace fitness and lifestyle program at Esso Resources between 1981 and 1990. Of the total 3,080 employees, pre-test data were available for 3,056. A total of 523 employees dropped out of the program within their first year of membership and therefore, post-test data were available for a total of 2,533 members. However, missing data were evident for several of the fitness, lifestyle behaviours and health status measures among the employees, for reasons that are not readily apparent.

Post-test data were defined as the average of scores collected at all reassessments following the initial year of participation in the fitness and lifestyle program. This summary statistic was used for three reasons. Firstly, the high number of cases that entered the program at different times throughout the ten years, and the varying length of membership that was maintained resulted in a high degree of left and right censoring of the data. Meaningful answers using classical MANOVA with repeated measures would have been impossible because of the high percentage of missing data which necessitates casewise deletion. Secondly, fitness and lifestyle program members displayed a high degree of variability in their level of participation from year to year, changing between non-active, occasionally active and regularly active status. Therefore, the use of the last value, or maximum value attained during annual reassessments as the post-test score would introduce bias to the results. Finally, it is reasonable to expect the largest changes in fitness to occur within the first 3 to 6 months following initiation of a program of this nature, after which fitness levels tend to plateau and be maintained rather than improved. The average over the years following the pre-test score seemed, therefore, to be a reasonable, conservative, and the most generalizable post-test score to use for analysis purposes.

4.5.2 Study 1 Population Demographics

Table 4.1 provides demographic data for the members of the fitness and lifestyle program for the period 1981 to 1990. At Esso, females comprised approximately 35% of the workforce, whereas they made up 41% of the fitness and lifestyle program membership. The gross monthly income among all employees at Esso averaged approximately $4,400, while members of the fitness and lifestyle program averaged approximately $3,525 for the same period. This is reflective of the higher proportion of female fitness and lifestyle program members and the fact that females made up a greater proportion of the lower income earners at Esso. In fact, females represented only 28% of the 2,261 management/professional/technical employees, and a smaller 12% of the 830 employees who earned an average monthly salary in excess of $4,500.

Employees at Esso were well-educated, all having completed at least 1 year of post-secondary education. Male employees, however, represented a greater proportion (75%) of those with at least 4 years of post-secondary education. In general, females represented a greater proportion of employees who were under 25 years of age, were single and had fewer dependent children under six years of age.

4.5.3 Participation in the Fitness and Lifestyle Program

This section provides an overview of participation in the fitness and lifestyle program for the period 1981 to 1990. In the main, the data are descriptive, and are intended to provide a portrait of those employees who were members of the program.

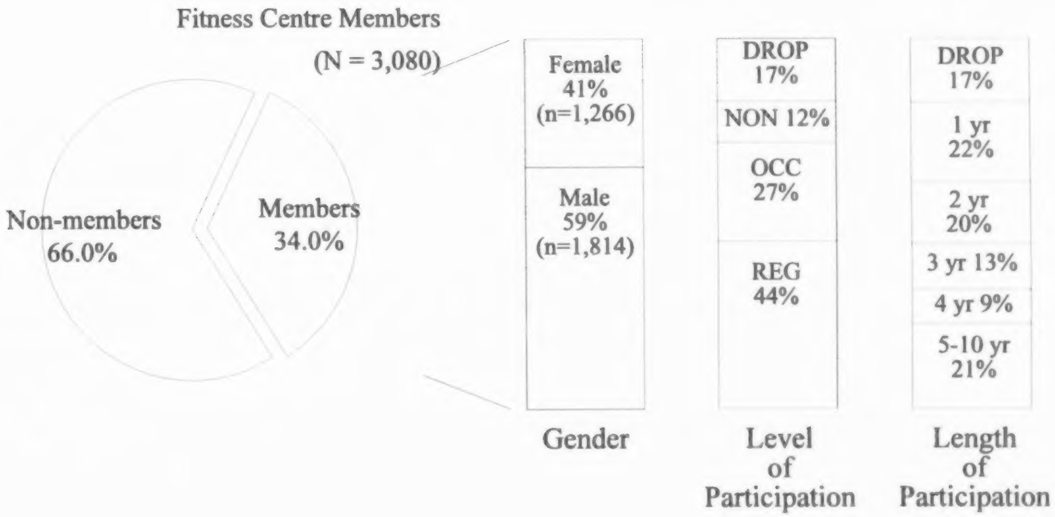
Over the ten years of programming, 3,151 employees joined the fitness and lifestyle program, of which data were available for 3,080. This represented a total of 6,948 annual memberships, or approximately 34% of the total annual workforce. Of these, 17% (n = 532) dropped out of the program within their first year of membership. Participants were classified by gender, level and length of participation (Figure 4.1).

Table 4.1 **Demographic Make up of Fitness and Lifestyle Program members by Gender**

Variable		Female (n = 1,266)	Male (n = 1,814)
Age	≤ 24 years	304 (24 %)	172 (9 %)
	25 - 44 years	873 (69 %)	1,297 (72 %)
	≥ 45 years	89 (7 %)	345 (19 %)
Education	< 4 years	848 (67 %)	671 (37 %)
	4 years	203 (16 %)	435 (24 %)
	> 5 years	215 (17 %)	708 (39 %)
Marital Status	Single	570 (45 %)	526 (29 %)
	Divorced	82 (6 %)	36 (2 %)
	Separated	32 (2 %)	18 (1 %)
	Married	582 (46 %)	1,234 (68 %)
Dependents <6yr	None	1,000 (79 %)	1,234 (68 %)
	1 to 4	266 (21 %)	580 (32 %)
Occupation	Mgt/Prof/Tech	646 (51 %)	1,615 (89 %)
	Administrative	620 (49 %)	199 (11 %)
Monthly Salary	< $2500	557 (44 %)	99 (7%)
	$2500 - 3499	430 (34 %)	255 (18 %)
	$3500 - 4499	177 (14 %)	284 (20 %)
	$4500 - 5999	76 (6 %)	397 (28 %)
	> $6000	26 (2 %)	383 (27 %)
Tenure at Esso	up to 1 year	405 (32 %)	345 (19 %)
	2 - 5 years	316 (25 %)	308 (17 %)
	6 - 8 years	291 (23 %)	399 (22 %)
	9 - 12 years	165 (13 %)	290 (16 %)
	13 or more years	88 (7 %)	472 (26 %)

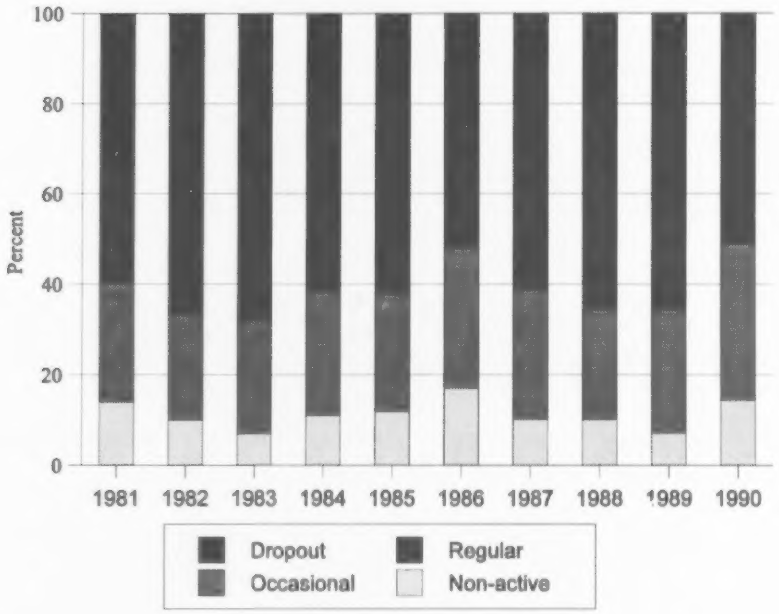
During the first year in 1981, 1,085 individuals joined the fitness and lifestyle program, and annual program membership over the next nine years averaged approximately two-thirds of the initial year, with the exception of 1986, when the annual membership totaled 1,131 employees. Approximately 12% (n = 370) of the members reported being non-active, despite maintaining their membership, and this figure remained fairly constant each year, with the exception of 1986, when the proportion of non-active members rose to 17%.

Figure 4.1 **Fitness and Lifestyle Program Participation January 1981 to December 1990**



Over the ten years, an average of 17% of the fitness centre members dropped out of the program within their first year of membership. The likelihood of dropping out fluctuated depending upon the year, with the highest rate, 35% occurring in the first year of the program, with a low of 3% in 1990. Twenty-seven percent of the fitness centre members (n = 832) reported being occasionally active, which remained fairly constant over the ten-year period, and 44% (n = 1,355) said they were regularly active, though the proportion fluctuated depending upon the year. The likelihood of being regularly active ranged from a low of 25% (n = 271) in 1981, to a high of 53% in 1982 (n = 360) and 1990 (n = 287) (Figure 4.2).

Figure 4.2 **Fitness and Lifestyle Program Membership by Year and Level of Participation**



Noticeable peaks in annual membership were seen in 1981 and again in 1986. These provided convenient cut-points to develop two, five year cohorts for comparisons to illustrate any changes that occurred in the membership over the ten years of fitness and lifestyle program operation. In comparing the first five years of the program to the second, participation among employees at various levels remained constant, the exception being the proportion of fitness centre members who dropped out of the program, which decreased from 21% (n = 647) to 14% (n = 431). However, if the high drop-out rate which occurred in 1981, the first year of program operation, is ignored, then the difference between the two five-year cohorts disappeared.

4.5.3.1 Gender and Participation

The Chi-Square-based Coefficient of Contingency was used to determine the strength of association between gender and level of participation. This measure is appropriate for use with nominal variables. The coefficient of contingency attempts to modify the chi-square statistic to minimize the influence of sample size and degrees of freedom as well as to restrict the range of values of the measure to those between 0 and 1. The coefficient of contingency was obtained using the CROSSTAB program of SPSS software and is calculated using the following formula:

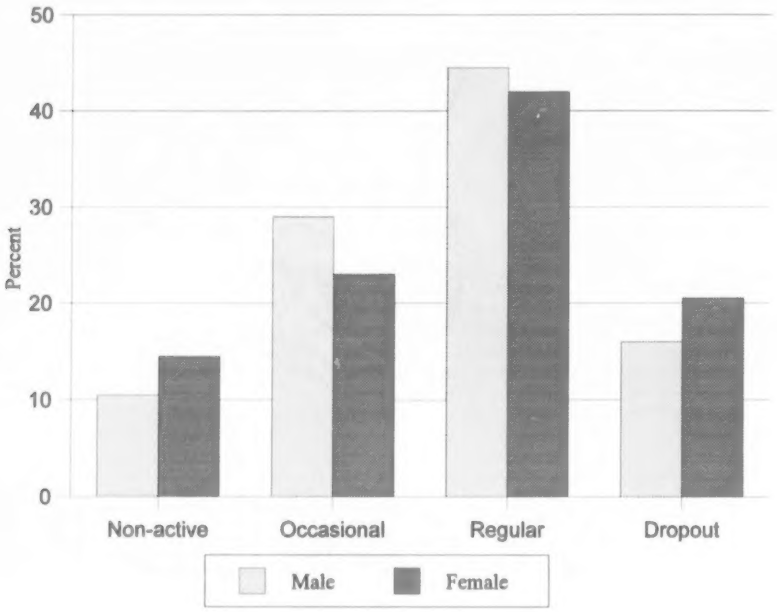
$$C = \sqrt{\chi^2/\chi^2+N}$$

Although the value of this measure is always between 0 and 1, it cannot generally attain the upper limit of 1. The maximum value possible depends upon the number of rows and columns, and is determined by:

$$\text{Upper limit of } C \text{ (u.l.)} = \sqrt{(\text{rows}-1)/\text{columns}}$$

A weak but significant ($C = 0.11$; u.l.= 0.5; $p<0.0005$) association was found to exist between gender and level of participation and was dependent upon age. Males and females were equally as likely to be regularly active fitness centre members at all age groups. However, males over the age of 25 were more likely to be occasional participants, while females under age 44, were more likely to be non-active. Females over age 45 were more likely than males to drop out (Figure 4.3).

Figure 4.3 **Fitness and Lifestyle Program Membership by Level of Participation and Gender**

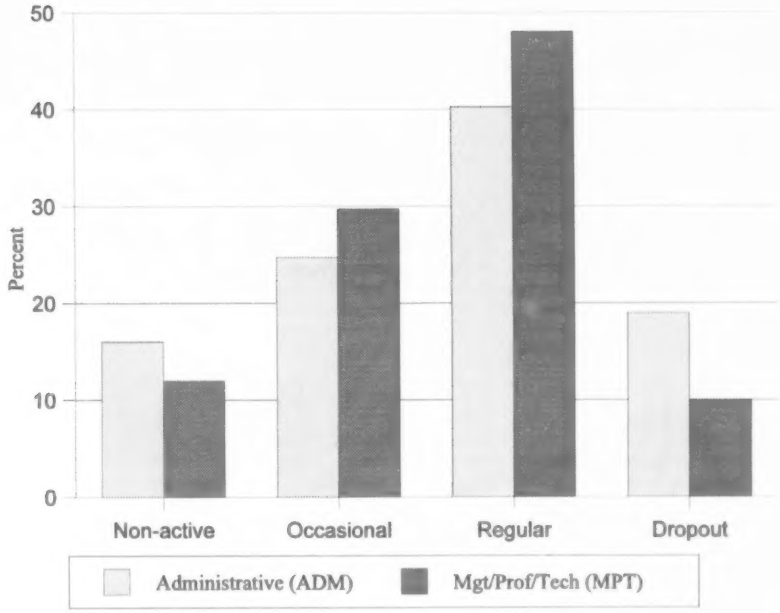


4.5.3.2 Social Status and Participation

A weak, but significant association existed between occupational classification and level of fitness and lifestyle program participation (C = 0.13; u.l. = 0.5; $p<0.0005$). Employees classified as Management/Professional/Technical (MPT) were more likely to be regularly or occasionally active than were those in the Administrative (ADM) group. In turn, employees in the ADM group were more likely to be non-active or drop-out (Figure 4.4). These relationships were true, regardless of gender.

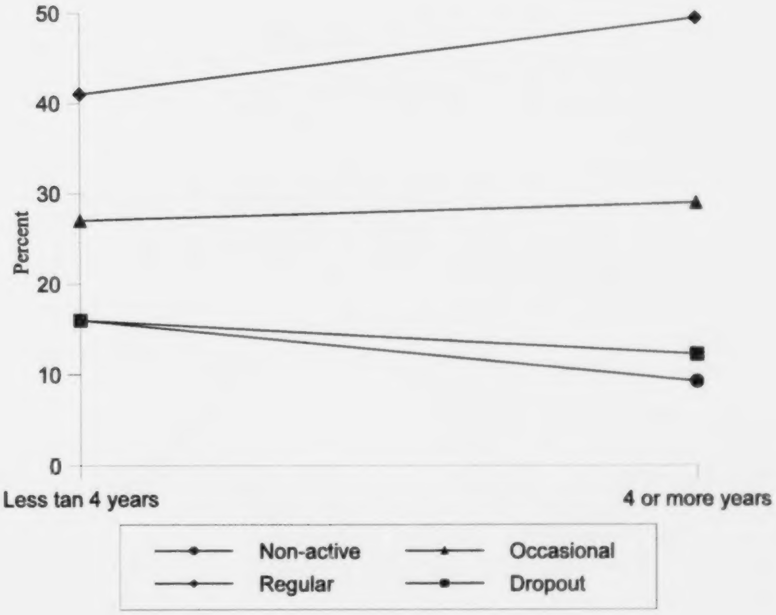
Gender, however, was significantly related to occupational classification at Esso ($C = 0.40$; u.l. = 0.7; $p<0.0005$). Of the male employees, 1,615 (89%) were classified as MPT during the period 1981 to 1990. While the female employees were equally split between MPT and ADM, they represented only 28% of the 2,261 management/professional/technical employees.

Figure 4.4 **Fitness and Lifestyle Program Participation by occupational classification**



In previous studies, education has been shown to have a strong positive link to participation in physical activity (Stephens & Craig, 1990), and health status (Stephens, et al., 1985). The findings of the present study tend to support this relationship, though the strength of association is very weak (C = 0.14; u.l. = 0.7; p<0.0005). Regardless of gender, employees with less than 4 years of post-secondary education were more likely to drop-out or report that they were non-active, than their counterparts with 4 or more years of post-secondary education. Conversely, employees with 4 or more years were more likely to report that they were regularly active than those with less than four years. Being an occasional participant in the fitness centre was not related to the amount of post-secondary education (Figure 4.5).

Figure 4.5 **Fitness and Lifestyle Program Participation by years of post-secondary education completed**



4.5.4 Changes in Fitness Following Participation in the Fitness and Lifestyle Program

Of interest to the sponsors and participants of the Esso Resources headquarters fitness and lifestyle program, was whether participation in the program resulted in changes in levels of fitness among participants. Of particular interest were the effects of level and length of participation on changes in fitness levels. In order to clarify the relationships, a multivariate factorial 3 x 2 x 5 (level x gender x length) analysis of variance (MANOVA) was employed. Initially, the design included the investigation of the interaction between the three factors of interest. However, due to the large number of cells (30), the potential for many significant, but practically meaningless interactions, and the effects of missing data resulting in casewise deletion, it was necessary to restrict the analyses to consideration of the effects of the three factors on the fitness measures individually.

4.5.4.1 The Fitness Measures

The first step was to conduct a preliminary screening of the individual fitness variables to determine information about the distribution of each and to identify unusual or outlying values. Stem-and-leaf plots and normal probability plots were constructed for each variable. Upon first examination, the variables, with the exception of the number of sit-ups, were approximately normal except for a right skew. The sit-up variable represented a bi-modal distribution, clustered heavily at a maximum value of 40. A clarification of the measurement of sit-ups during annual assessments revealed that members were told to stop after achieving 40 sit-ups in 1-minute. A very small number continued beyond 40, presumably for the personal challenge. The effects of gender, level and length of participation on the number of sit-ups was, therefore, assessed using non-parametric procedures.

Figure 4.6 illustrates the normal probability plots for I) sit-and-reach flexibility (FLEX); ii) predicted maximal oxygen uptake (VOmax); and, iii) resting diastolic blood pressure (RDBP). Figure 4.7 illustrates that log transformations were beneficial for: I) sum of skinfolds (SOS); ii) body mass index (BMI); and somewhat for, iii) waist-to-hip ratio (WHR), and resulted in probability plots closer to the normal line. Power transformations may have resulted to bring BMI and WHR

Figure 4.6 Normal Probabilty Plots for Mean Flexibilty, VO_2max and Resting Diastolic Blood Pressure

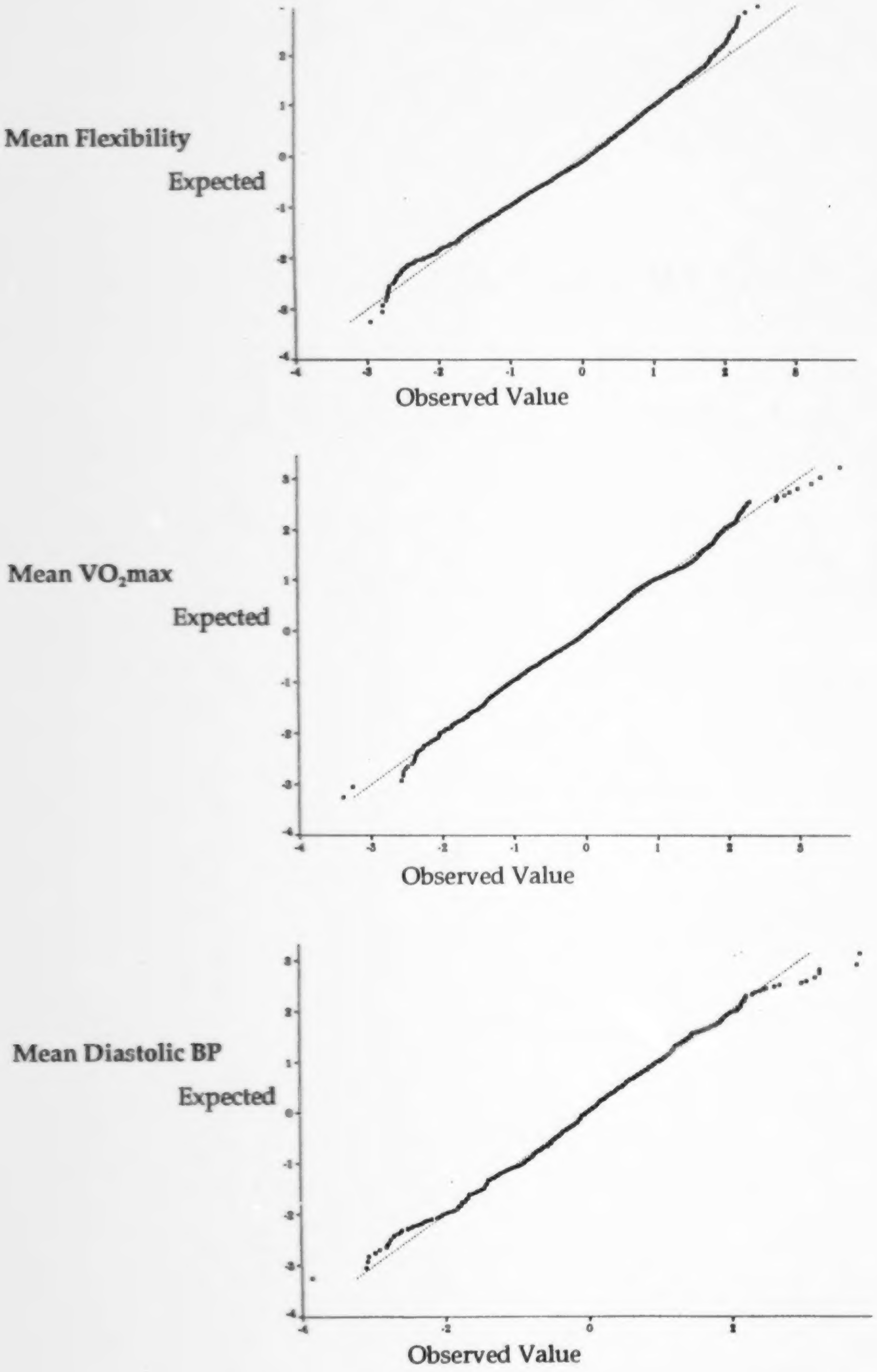
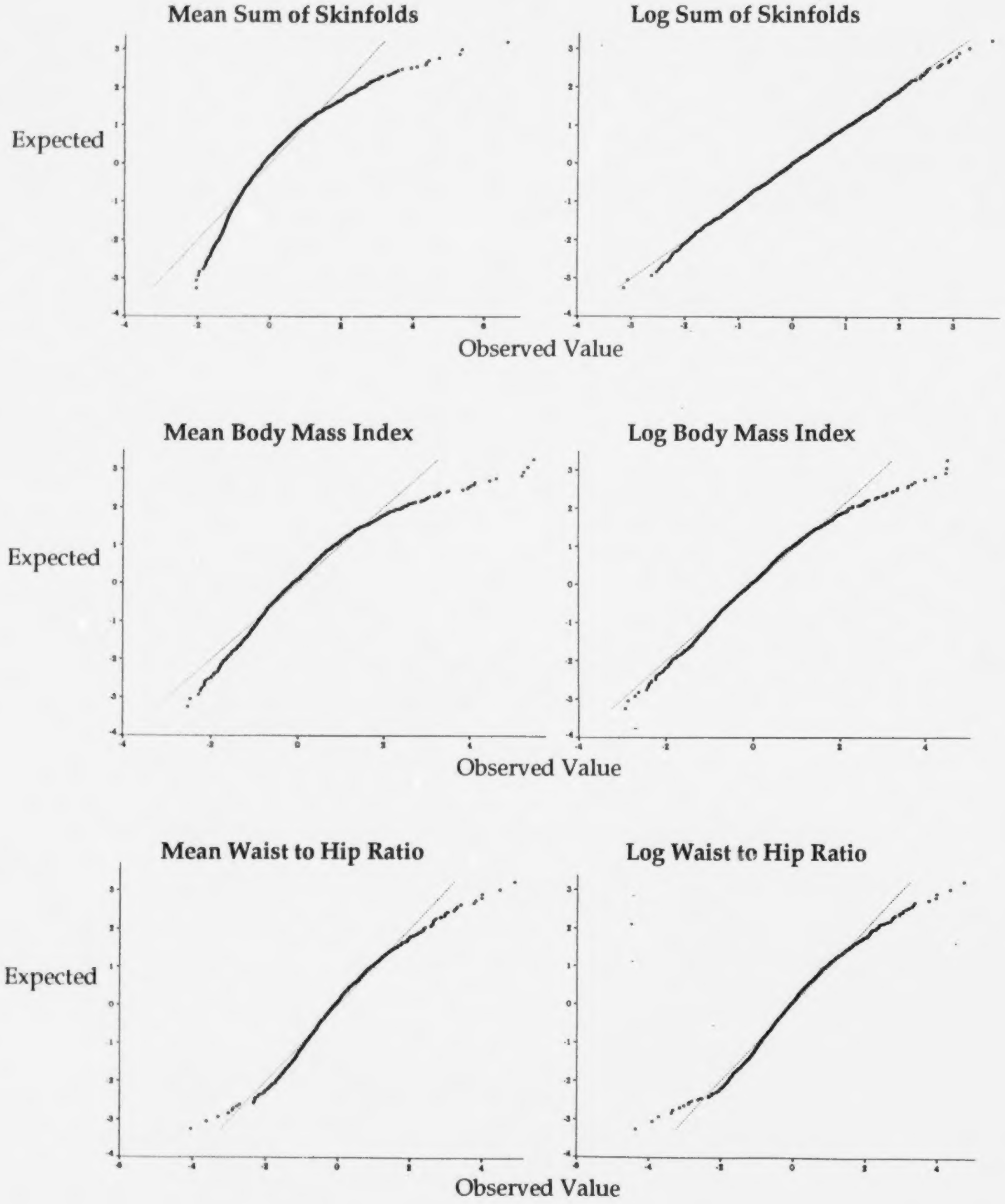


Figure 4.7 **Normal Probabilty Plots for the Mean and Log transformation of Sum of Skinfolds, Body Mass Index and Waist to Hip Ratio**



nearer to normality, but it was judged that the MANOVA procedure was sufficiently robust to accommodate the three variable distributions that resulted from the log transformation.

Box's *M* test, which is based on the determinants of the variance-covariance matrices in each cell as well as the pooled variance-covariance matrix, provides a multivariate test for the homogeneity of the variable matrices (Norousis, 1992). However, Box's *M* test is very sensitive to departures from normality. The significance level in this case is based on the *F* statistic. Table 4.2 indicates the results of Box's *M* test for the homogeneity of the pooled variance-covariance matrix for the fitness variables under study.

Table 4.2 Multivariate test for Homogeneity of Dispersion Matrices

Box's M =	1215.08	
F with (504,48106) DF =	2.21	p = 0.000 (approx)

The result of Box's *M* test suggest that there is reason to suspect the homogeneity of dispersion matrices assumption. However, given the fact that the sample size in this case is large (n = 3,080), the likelihood of many very small effects achieving statistical significance is increased, but are of little practical importance. Final interpretations of the data will be made by reviewing the raw scores and effect sizes, and not purely on the test of significance.

4.5.4.2 The Effects of Gender, Level and Length of Participation on Fitness

Table 4.3 contains the value of Pillais' trace statistics for the tests of the hypotheses that gender, level and length of participation have no effect on measures of fitness. Two concerns dictate the choice of the multivariate criterion-power and robustness. That is, the test statistic should detect differences when they exist and not be much affected by departures from the assumptions. The significance level is based on the *F* distribution, and Pillais' trace is both the most powerful and robust. That is, the significance level based on it is reasonably correct even when the assumptions are violated. This is important in this study where mild violations of homogeneity of the variance-covariance matrices exist.

Table 4.3 **Multivariate tests of significance for the Effects of Gender, Level and Length of Participation on Fitness**

Multivariate tests of significance (Pillais' Trace)					
Effect	**Value of Pillais' Trace**	**Approx. *F***	**Hypoth. DF**	**Error DF**	**Sig. of F**
Gender	0.769	941.859	6.00	1698.00	0.000
Level	0.945	14.045	12.00	3398.00	0.000
Length	0.018	1.306	24.00	6804.00	0.145

Note: *F* statistics are exact for Gender

The observed significance levels are small (p<0.0005) in both the effects of gender and level of participation. The null hypotheses that gender, and level of participation have no effect on the measures of fitness are therefore rejected. These results come as no surprise. The difference in fitness parameters between the sexes is well documented (Mathews & Fox, 1971), and the differences in fitness levels between active and inactive individuals is well understood (Astrand & Rodahl, 1977). Length of participation as an individual factor showed no effect on fitness levels.

To understand where the differences in scores related to gender and level of participation occurred, the univariate tests for the individual variables was examined. As seen in Table 4.4, significant differences were apparent between the sexes on all fitness measures, and among the non-active, occasionally active and regularly active on all fitness measures with the exception of resting diastolic blood pressure.

Table 4.4 Univariate *F*-tests for the Effects of Gender and Level of Participation on Fitness

GENDER Univariate F-tests with (1,1703) DF

Variable	Hypoth SS	Error SS	Hypoth MS	Error MS	F	Sig. of F
BMI	3.738	21.905	3.738	0.013	290.642	0.000
SOS	13.933	193.863	13.933	0.114	122.396	0.000
WHR	11.849	7.672	11.849	0.005	2630.422	0.000
FLEX	12917.624	161065.126	12917.624	94.577	136.583	0.000
VO2	24375.927	60271.8227	24375.927	35.391	688.750	0.000
RDBP	20734.143	99309.318	20734.143	58.314	355.558	0.000

LEVEL OF PARTICIPATION Univariate F-tests with (2,1703) DF

Variable	Hypoth SS	Error SS	Hypoth MS	Error MS	F	Sig. of F
BMI	0.235	21.905	0.117	0.013	9.120	0.000
SOS	7.198	193.863	3.560	0.114	31.616	0.000
WHR	0.212	7.672	0.106	0.004	23.570	0.000
FLEX	6610.108	161065.054	3305.054	94.578	34.945	0.000
VO2	3772.666	60271.827	1886.333	35.391	53.299	0.000
RDBP	108.627	99309.318	54.313	58.314	0.931	0.394

4.5.4.2a Gender and Measures of Fitness

Pre-test and post-test fitness measures, difference scores and effect sizes for all fitness and lifestyle program participants are detailed in Table 4.5. Changes in fitness levels in both males and females are in a direction that is considered positive from a fitness and health standpoint. However, the effect sizes range from zero to medium and most are very small as judged by the criterion established by Cohen (1988), ranging from 0, in the case of WHR in males, to .24 in SITUP in females.

Table 4.5 Pre-test, Post-test and Effect Sizes[1] for male and female employees who participated in the fitness and lifestyle program between 1981 and 1990.

Variable	Pre-test	Post-test	Difference	Effect size
MALE				
BMI (wt/ht^2)	24.45 ± 2.77	24.31 ± 2.79	- 0.14	- 0.05
SOS (mm)	58.86 ± 21.84	56.36 ± 21.96	- 2.50	- 0.11
WHR	0.88 ± 0.06	0.88 ± 0.09	0	0
SITUP (#/min)	13.08 ± 14.54	15.91 ± 14.15	2.83	n/a
FLEX (cm)	26.93± 10.76	28.91 ± 10.10	1.98	0.18
VO2 (ml/kg//min)	43.33 ± 7.19	44.42 ± 7.34	1.09	0.15
RDBP (mmHg)	81.14 ± 8.48	79.76 ± 8.30	- 1.38	- 0.16
FEMALE				
BMI (wt/ht^2)	22.31 ± 3.20	22.11 ± 3.11	- 0.20	- 0.06
SOS (mm)	69.72 ± 26.63	65.79 ± 24.68	- 3.93	- 0.15
WHR	0.75 ± 0.07	0.74 ± 0.09	- 0.01	- 0.14
SITUP (#/min)	12.99 ± 14.62	16.43 ± 14.92	3.44	n/a
FLEX (cm)	32.06 ± 9.92	34.17 ± 10.70	2.11	0.21
VO2 (ml/kg//min)	35.93 ± 5.05	36.46 ± 7.36	0.53	0.10
RDBP (mmHg)	74.09 ± 8.64	72.89 ± 9.06	- 1.20	- 0.14

[1] mean (post-test) - mean (pre-test) / s.d. (pre-test)

Utilizing the Kruskal-Wallis one-way analysis of variance, gender was found to have no effect on the number of situps.

Despite the changes in fitness in both males and females as a consequence of involvement in the fitness and lifestyle program, in practical terms they were inconsequential. Using the normative data for Canadians established from the Canada Fitness Survey (1981), both male and female scores on all measures reflected the "average" category for each respective gender (age group 30-39) at pre-test and post-test. Further, the large variances associated with both pre-test and post-test measures suggest caution in relying on the significance statistic as a measure of change.

4.5.4.2b Level of Participation and Measures of Fitness

In order to determine the individual effect of the three levels of participation on each of the fitness variables, a series of contrasts between levels were formed to determine the significance of differences between them. There are several contrasts available using the MANOVA procedure on SPSS, and the Helmert contrast was most appropriate in this case. Each level of participation, except the last is compared to the mean effect of the subsequent levels. That is, in contrast 1, NON is compared to the mean effect of OCC and REG, and in contrast 2, OCC is compared to the effect of REG. In this way, it is possible to determine the effect of each level of participation on each post-test measure of fitness.

Table 4.6 indicates the results of the Helmert contrasts for the effect of level of participation on fitness. As shown, the difference in effect between NON and the mean of REG and OCC was significant in all measures of fitness, with the exception of resting diastolic blood pressure. Similarly, the difference in effect between OCC and REG was also significant for each measure of fitness except resting diastolic blood pressure and body mass index. A gradient effect was, therefore, apparent with regard to the effects of level of participation in the fitness and lifestyle program on fitness, with the exception of resting diastolic blood pressure. At post-test, those who were regularly active were more fit than those who were occasionally active. In turn, those who were occasionally active were more fit than non-active employees.

In defining levels of participation, there was a group of employees who dropped out of the program within the first year of membership for reasons that are unclear (DROP). In order to better understand the impact of this group on the data, the DROP group was combined with NON and with REG in two further analyses. These analyses were completed separately in a post-hoc fashion and did not affect the original NON, OCC, REG analysis. Nonetheless, they acknowledged the possibility that the DROP group affected the results in some fashion, and permitted a greater understanding of the effect of level of participation on fitness.

Table 4.6 Helmert Contrasts for the Effect of Level of Participation on Fitness

Variable	Contrast[1]	Coeff.	Std. Error	t - value	Sig. of t
BMI	1	0.0316	0.0076	4.1611	0.0000
	2	0.0046	0.0063	0.7257	0.4681
SOS	1	0.1459	0.0226	6.4576	0.0000
	2	0..0802	0.0188	4.2690	0.0000
WHR	1	0.0245	0.0045	5.4507	0.0000
	2	0.0144	0.0037	3.8611	0.0001
FLEX	1	-4.1132	0.6153	-6.3151	0.0000
	2	-2.7704	0.5418	-5.1137	0.0000
VO2	1	-3.2416	0.3984	-81358	0.0000
	2	-1.9514	0.3314	-5.8881	0.0000
RDBP	1	0.5500	0.5114	1.0754	0.2824
	2	0.3312	0.4254	0.7785	0.4364

[1] Contrasts: 1 = NON vs mean(OCC+REG)
2 = OCC vs REG

Table 4.7 indicates the mean values for the group of employees who dropped out of the program within the first year. Column 2 lists the mean pre-test values on the fitness measures (DROP). Column 3, the weighted mean values for DROP+NON, and column 4, the weighted mean values for DROP+REG.

Table 4.7 Mean Values for Measures of Fitness for the Group of Employees who Dropped Out of the Fitness and Lifestyle Program

Variable	Mean (DROP)	Mean (DROP+NON)	Mean (DROP+REG)
BMI	23.64	23.01	23.52
SOS	64.37	66.39	64.40
WHR	0.82	0.79	0.82
FLEX	28.81	30.32	29.08
VO2	40.32	38.41	40.19
RDBP	78.18	76.18	77.97

The effect of these recombinations on the multivariate analysis of variance were negligible. The multivariate tests remained significant regardless of whether the effect of the DROP group was being considered in combination with the NON or the REG group (Pillais' trace = 0.0521; 18,9099 DF; p<0.0005). Similarly, the univariate tests were unaffected by the recombinations; all fitness measures remained significant with the exception of resting diastolic blood pressure. Therefore, it can be concluded that the group of employees who dropped out of the program were similar in their pre-test fitness levels to those who stayed, and they had no consequence on the understanding of the effect of level of program participation on fitness.

Having determined that in this employee population, level of participation in the workplace fitness and lifestyle program had a significant gradient effect on fitness, it is instructive to refer back to the summarized raw data to clarify the practical changes.

Table 4.8 indicates the pre-test, post-test, difference scores and effect sizes for

Table 4. **Pre-test, Post-test and Effect Sizes[1] by Level of Participation for employees who participated in the fitness and lifestyle program between 1981 and 1990.**

Variable	Group	Pre-test	Post-test	Difference	Effect size
BMI (wt/ht^2)	NON	24.21 ± 3.62	24.77 ± 3.14	0.56	0.15
	OCC	23.59 ± 3.12	23.55 ± 3.11	-0.04	- 0.01
	REG	23.39 ± 2.81	23.21 ± 2.79	- 0.18	- 0.06
SOS (mm)	NON	71.41 ± 26..29	73.84 ± 24.51	0.43	0.09
	OCC	62.65 ± 22.92	64.09 ± 24.68	1.44	0.06
	REG	59.08 ± 22.84	56.03 ± 21.96	- 3.05	- 0.13
WHR	NON	0.84 ± 0.10	0.85 ± 0.09	0.01	0.09
	OCC	0.83 ± 0.09	0.83 ± 0.09	0	0
	REG	0.82 ± 0.09	0.82 ± 0.09	0	0
SITUP (#/min)	NON	10.96 ± 11.97	12.65 ± 14.57	1.69	n/a
	OCC	13.44 ± 13.73	15.16 ± 14.92	1.72	n/a
	REG	15.94 ± 14.58	17.00 ± 14.15	1.06	n/a
FLEX (cm)	NON	25.79 ± 10.92	25.21 ± 10.72	- 0.58	- 0.05
	OCC	27.98 ± 9.93	29.87 ± 10.70	1.89	0.19
	REG	30.85 ± 10..52	32.30 ± 10.10	1.45	0.14
VO2 (ml/kg//min)	NON	40.20 ± 6.93	39.86 ± 7.38	- 0.34	- 0.05
	OCC	37.28 ± 6.16	37.42 ± 7.36	0.14	0.02
	REG	41.55 ± 7.62	42.61 ± 8.30	1.06	0.14
RDBP (mmHg)	NON	78.24 ± 9.02	77.75 ± 9.22	- 0.49	- 0.05
	OCC	78.64 ± 9.30	76.97 ± 9.06	- 1.67	- 0.18
	REG	78.29 ± 9.37	77.10 ±	- 1.19	- 0.13

[1] mean (post-test) - mean (pre-test) / s.d. (pre-test)

the employees in the fitness and lifestyle program, grouped by their level of participation. Changes in fitness levels in the regularly active and occasionally active groups are generally in a direction that is considered positive from a fitness and health standpoint, whereas those in the non-active group reflect changes in a direction toward reduced fitness. As with the effect of gender, however, the effect sizes range from zero to medium with most being very small as judged by the criterion established by Cohen (1988), ranging from 0, in the case of WHR in the occasional and regularly active groups, to .26 in SITUP in the regularly active group.

The effect of level and length of participation on situps was analyzed using the Kruskal-Wallis one-way analysis of variance. As with the previously discussed fitness measures, level of participation was found to have a significant effect on situps ($\chi^2 = 33.925$; 3 DF; $p<0.0005$). Unlike the others, however, length of participation was also found to have an effect ($\chi^2 = 40.785$; 4 DF; $p<0.0005$). Contrasts were established to better understand the source of the effect.

Firstly, with regard to level of participation, simple contrasts to determine if the DROP group differed from the other groups were completed. The DROP group scored significantly more situps (14.07 vs 10.96) than the NON group ($\chi^2 = 17.173$; $p<0.0005$), and significantly less (14.07 vs 15.94) than the REG group ($\chi^2 = 17.173$; $p<0.0005$), but no different than the OCC group. Secondly, the NON, OCC and REG groups were compared. The REG group scored significantly more situps (15.94 vs 13.44) than the OCC group ($\chi^2 = 12.163$; $p=0.0005$), who in turn scored significantly more (13.44 vs 10.96) than the NON group ($\chi^2 = 7.025$; $p=0.008$). Finally, the DROP was recombined with the NON and REG groups to conduct two comparisons to determine the effect of the dropouts. When DROP was combined with NON and compared to OCC, there were no significant differences. However, when DROP and REG were combined and compared to OCC, the combined group scored significantly more situps ($\chi^2 = 15.812$; $p=0.0001$).

The gradient effect of level of participation was similar in situps as in other fitness measures when the DROP group were excluded from the analyses. However, because the DROP group had significantly higher scores on situps than the NON group at pre-test, their inclusion in an analysis with NON would have biased the results, and negated the gradient effect. Recombining DROP with NON and REG in separate analyses clarifies this bias.

Four contrasts were constructed to determine the significant effect of length of participation on situps and to clarify the cumulative effect of time in the fitness and lifestyle program. In contrast 1, participating for one year was compared to participation for two years; in contrast 2, the mean score of one and two year's participation was contrasted with three years, and so on until the mean of participating for one, two, three and four years was contrasted to the mean of participating for five to ten years. The results of these contrasts appear in Table 4.9.

Table 4.9 Difference Contrasts for the Effect of Length of Participation on Situps

Contrast	Chi-Square	Significance
1 Year to 2 Years	0.3255	0.5683
Mean (1,2) Years to 3 Years	4.1988	0.0405
Mean (1,2,3) Years to 4 Years	2.5638	0.1093
Mean (1,2,3,4) Years to 5-10 Years	33.6184	0.0000

Participation in the fitness and lifestyle program for between five to ten years had a significant effect on the number of situps that were performed. The significant difference observed in contrast 2, resulted from a mean score of 11.57 situps in year 3 compared to means of 14.07 in year 1, and 14.27 in year 2. Four years of participation resulted in a mean score of 14.76 situps, and 5-10 years in 18.89 situps. The low scores experienced as a result of three years participation are unclear, but a significant increase in the number of situps is associated with more than five years participation in the fitness and lifestyle program.

Comparing the results of the changes in fitness experienced as a result of participating in the fitness and lifestyle program at Esso to the Canada Fitness Survey (1981), norms (age 30-39) helps to assess the impact. As a group, the non-active employees ranged between the "poor" and "below average" categories, the occasionally active between "below average" and "average", and the regularly active in the "average" category on fitness measures at both pre-test and post-test. In this regard, it can be stated that the fitness and lifestyle program appears to provide a successful means whereby employees who are active, either regularly or occasionally, were able to maintain and possibly achieve some average level of fitness.

In summary, while the results support a significant linear relationship between level of participation and fitness, and the direction of change in fitness measures in the active groups was positive and supports the previous research regarding the frequency of exercise required to maintain and achieve improved fitness (Mathews & Fox, 1971; Astrand & Rodahl, 1977), the magnitude of the changes are minimal and inconsequential from a practical standpoint.

4.5.4.3 Employees at Risk due to Obesity

Between 1981 and 1990, approximately 20% (n = 613) of the fitness and lifestyle program membership demonstrated an increased risk to future health as a result of obesity as defined by the Canada Fitness Survey (1981), norms. This was true whether obesity was defined by Excess Weight (measured by BMI), Excess Fat (measured by SOS), or Fat Distribution (measured by WHR). However, as Table 4.10 shows, significant reductions in the proportion of employees at risk due to obesity occurred over the ten years of operation of the fitness and lifestyle program. When the first five years of operation was compared to the second five years, the segment of employees at future health risk from obesity reduced by an average of 10%, regardless of the obesity indicator used.

A very weak, but significant relationship was found between gender and measures of obesity ($C = 0.10$; u.l. = 0.6; $p<0.0005$). Males were at greater risk than females at all age groups. They were twice as likely to weigh too much for their height across all age groups, and were twice as likely to have increased waist-to-hip ratios, with the exception of employees under age 25. A greater number of employees were at risk with increasing age. However, the slope for males showed a

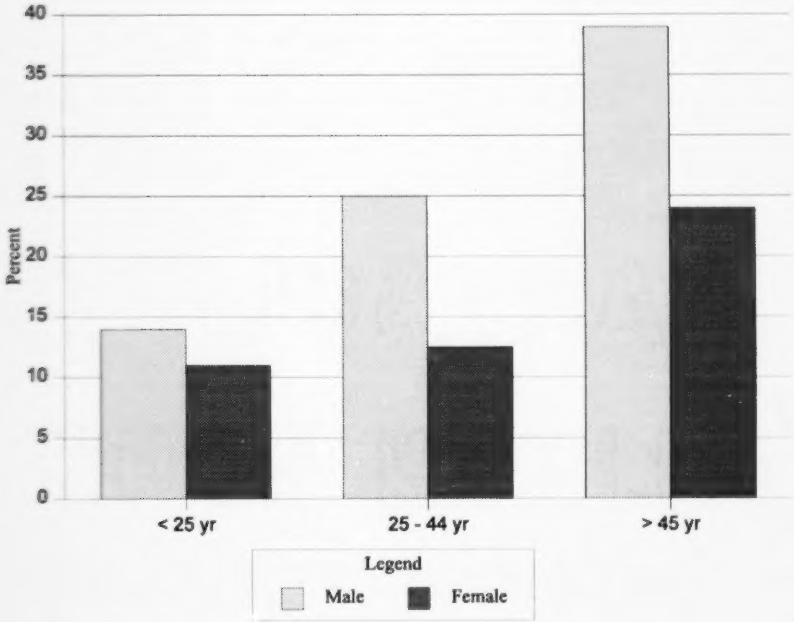
Table 4.10 **Body Weight, Skinfolds and Fat Distribution by gender, level of participation , age group and five-year cohort**

		Percent with Future Health Possibly at Risk Due to:					
		Excess Weight		Excess Fat		Fat Distribution	
		1981-85	1986-90	1981-85	1986-90	1981-85	1986-90
TOTAL		25 %	16 %	26 %	18 %	28 %	12 %
MALE (n=1,814)	≤ 24 yr	23 %	14 %	19 %	15 %	10 %	1 %
	25-44 yr	34	21	28	19	32	14
	≥ 45 yr	48	29	34	25	67	33
FEMALE (n=1,266)	≤ 24 yr	8 %	7 %	23 %	17 %	9 %	2 %
	25-44 yr	12	9	17	14	17	6
	≥ 45 yr	23	14	35	21	34	15
LEVEL OF PARTICIPATION:							
REG (n=1,355)	≤ 24 yr	10 %	14 %	14 %	19 %	7 %	4 %
	25-44 yr	21	24	16	21	18	12
	≥ 45 yr	39	41	23	40	50	46
OCC (n=832)	≤ 24 yr	16	15	25	38	9	5
	25-44 yr	29	32	29	35	31	23
	≥ 45 yr	41	48	42	45	64	56
NON (n=370)	≤ 24 yr	22	15	38	30	10	3
	25-44 yr	35	38	46	47	34	30
	≥ 45 yr	56	51	10	48	77	64
DROP (n=532)	≤ 24 yr	13	19	23	29	13	2
	25-44 yr	29	33	27	38	35	22
	≥ 45 yr	45	70	38	66	64	53

much sharper increase than for females. In females, regardless of the measure of obesity, the risk doubled after age 44 (Figure 4.8). In males over age 45, a doubling of risk occurred only in the measure of fat distribution (WHR), while the other measures demonstrated a relatively consistent rise after age 25.

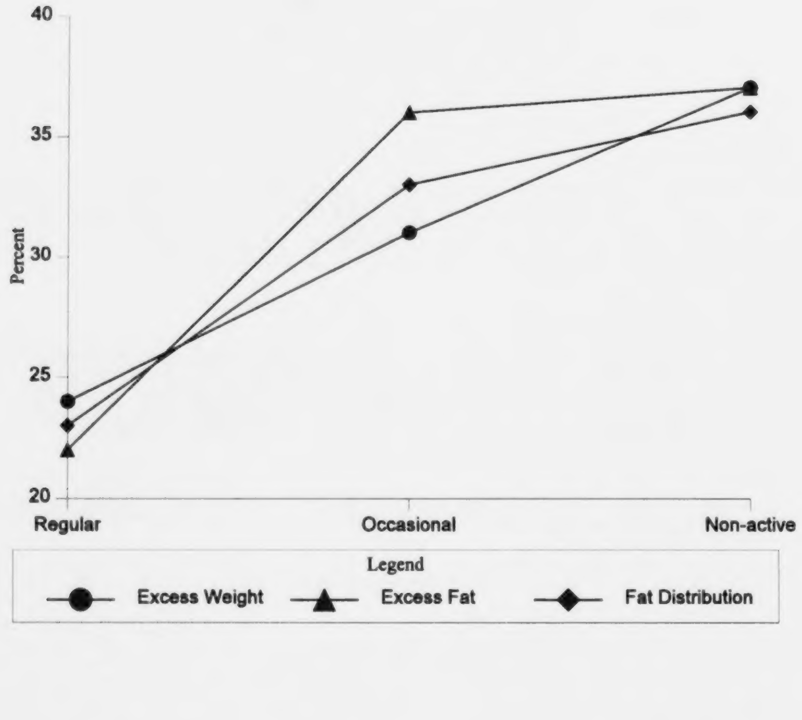
Regardless of age or gender, the risk to health from obesity was reduced in the second five-years of fitness centre operation. This was true for all three obesity measures.

Figure 4.8 **Employees at Risk due to Obesity[1] by Age group and Gender**



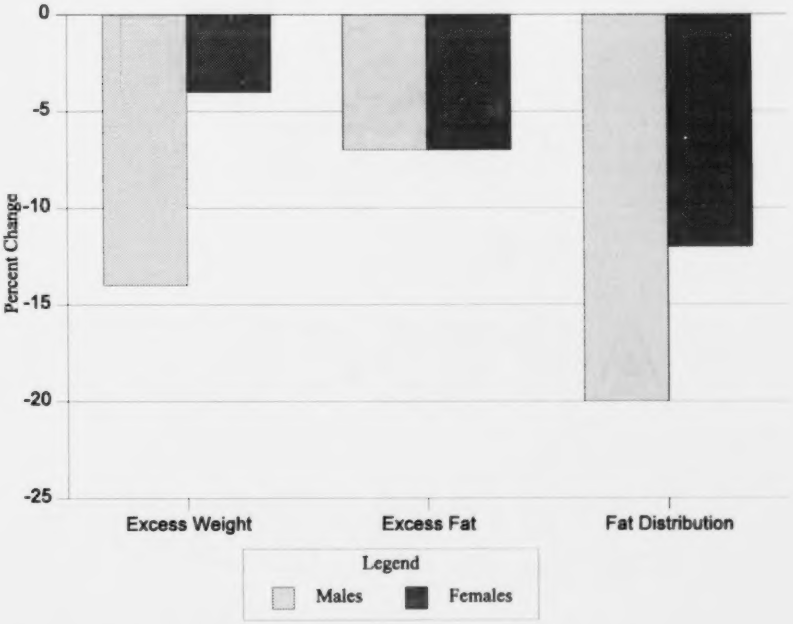
A weak linear relationship existed between participation level and future risk to health due to obesity ($C = 0.14$; u.l. $= 0.5$; $p<0.0005$), regardless of the measure used. The regularly active individuals displayed less risk than the occasionally active, who displayed less risk than the non-active. This relationship was true regardless of age, with the exception of over 45 year-olds, where little difference was seen between the occasionally active and non-active groups. Figure 4.9 illustrates the relationship between the three measures of obesity and fitness program participation level.

Figure 4.9 Employees at Risk due to Obesity by Level of Participation



In order to clarify the longer term effects of the fitness and lifestyle program on modifying the proportion of the employees at future risk to health from obesity, the first five years of operation was compared to the second five years. The segment of employees at risk from obesity was significantly reduced in both males and females, regardless of the obesity indicator used (Figure 4.10).

Figure 4.10 **Changes in Future Risk to Health Due to Obesity[1] among Fitness and Lifestyle Program Members between 1981-1985 and 1986-1990**



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[1] Average of Excess Weight, Excess Fat and Fat Distribution

4.5.5 Changes in Lifestyle Behaviours Following Participation in the Fitness and Lifestyle Program

The variables that reflect lifestyle behaviours included: the number of cigarettes, cigars and/or pipes smoked per day; nutrition habits; alcohol consumption; caffeine consumption; and, the amount of leisure time physical activity engaged in. The degree to which there were changes in these variables, concomitant to participation in the fitness and lifestyle program was analyzed in a 3 x 2 x 5 (Group x Gender x Length of Participation) Kruskall-Wallis (1952), one-way analysis of variance by ranks (with the exception of nutrition habits which was analyzed utilizing a 3 x 2 x 5 ANOVA).

The source of any significant effect of the length of participation was determined by conducting a series of difference contrasts where each category of length of participation was compared to the average effect of previous lengths of participation.

Each analysis was repeated three times in order to evaluate the effect of the program dropouts. The source of any significant effect of level of participation was determined by establishing a series of contrasts. Firstly, simple contrasts to determine if the DROP group differed from the other groups were completed. Secondly, the NON, OCC and REG groups were compared, and finally, the DROP was recombined with the NON and REG groups to conduct two comparisons to determine the effect of the dropouts.

4.5.5.1 Tobacco Smoking

Approximately 20% (n = 616) of the fitness centre membership reported being current smokers, 20% (620) were former smokers, and 60% (n = 1,844) reported they had never smoked. Of the 20% who were former smokers, half (n = 311) had quit since joining the fitness and lifestyle program.

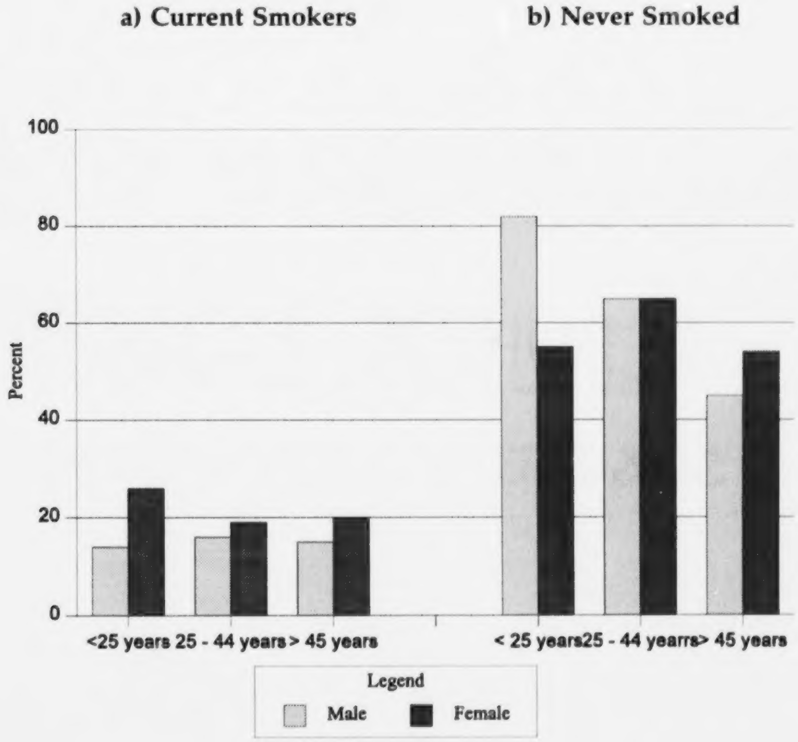
4.5.5.1a Gender and Smoking

There was a significant difference between males and females in their smoking habit ($\chi^2 = 22.37$; $p<0.0005$). Females were more likely than males to be current smokers at all age groups, though the difference was greatest among employees under

25 year-olds (Figure 4.11a). A greater proportion of males than females in the young age group reported that they had never smoked. This situation was reversed in the oldest age group (> 45 years), where 11% more females reported having never smoked (Figure 4.11b).

Females in the young age group were twice as likely as their male peers to have quit smoking since joining the program. Both male and female participants who smoked at the pre-test assessment reported a reduction in the number smoked per day as a result of their participation in the fitness and lifestyle program. The effect in females was larger than in males, with females reporting a reduction of 1.28 smokes per day vs 0.63 for males.

Figure 4.11 **Current Smokers and those who have Never Smoked by Age and Gender**


a) Current Smokers

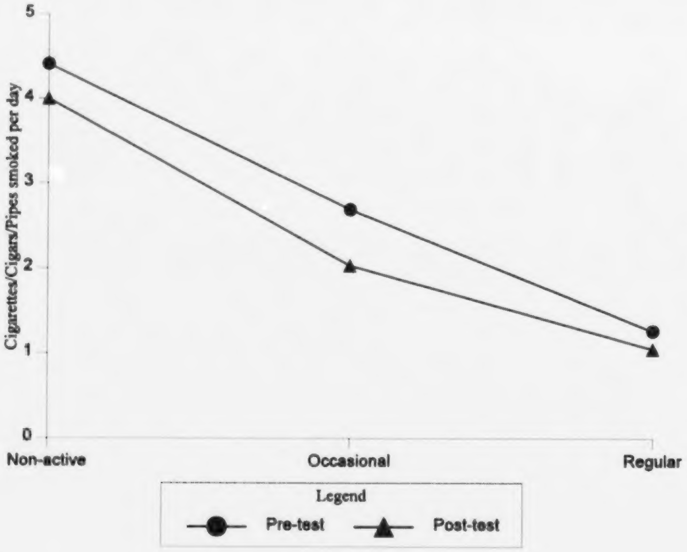
b) Never Smoked

4.5.5.1b Participation and Smoking

Length of participation was found to have a weak effect on smoking habit ($\chi^2 = 10.14$; 4 DF; $p<0.0381$). However, no clear pattern was apparent and difference contrasts failed to achieve significance. Therefore, the length of time in the fitness and lifestyle program that was associated with a reduction in the number of smokes per day is unclear.

There was a significant relationship between level of participation and smoking ($\chi^2 = 39.38$; 3 DF; $p<0.0005$). As participation increased, so did the likelihood of being a non-smoker. There was an inverse relationship among current smokers, between level of participation and the number smoked per day. Regularly active members (REG) smoked significantly fewer than the occasionally active (OCC) and non-active (NON) groups ($\chi^2 = 23.96$; $p<0.0005$), who were similar in their daily smoking habit (Figure 4.12). Finally, there was a small but positive increase in the proportion of smokers who quit smoking all together as level of participation increased (6 % more quitters were REG than NON).

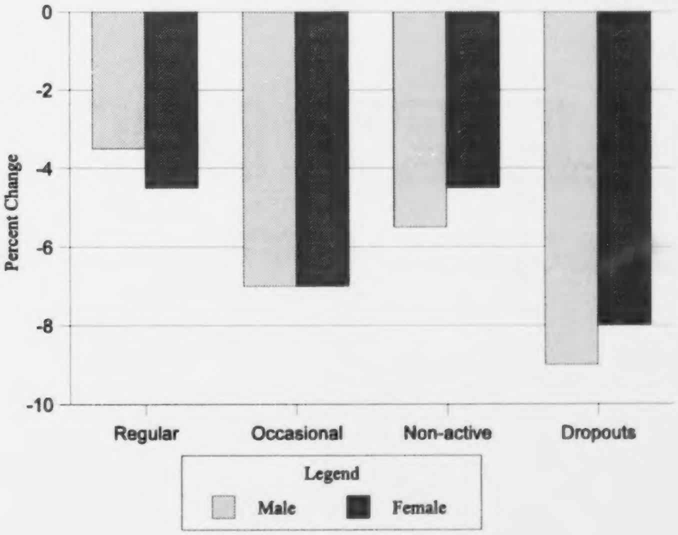
Figure 4.12 **Current Smokers and Level of Participation**



The group of dropouts (DROP) smoked significantly fewer ($\chi^2 = 6.89$; $p<0.0097$) per day than the NON group (2.87 vs 4.41), and significantly more ($\chi^2 = 20.33$; $p<0.0005$) than the REG at pre-test (2.87 vs 1.26). Recombining DROP with NON and REG, made no difference to the previous relationships: the OCC and NON groups smoked a similar number per day while the REG participants smoked significantly fewer and demonstrated a greater proportion of participants that quit smoking all together.

Daily smoking habit was reduced in all three participation groups. The practical effect of the reduction was minimal, however. The NON and OCC groups reduced daily smoking habit by 0.41 and 0.66, respectively, while the REG group reduced by 0.21 per day. In comparing the period 1981-1985 with 1986-1990, Figure 4.13 illustrates that, the proportion of employees who were current smokers was significantly reduced over the ten years of program operation. This relationship was true for all employees regardless of their gender or level of participation.

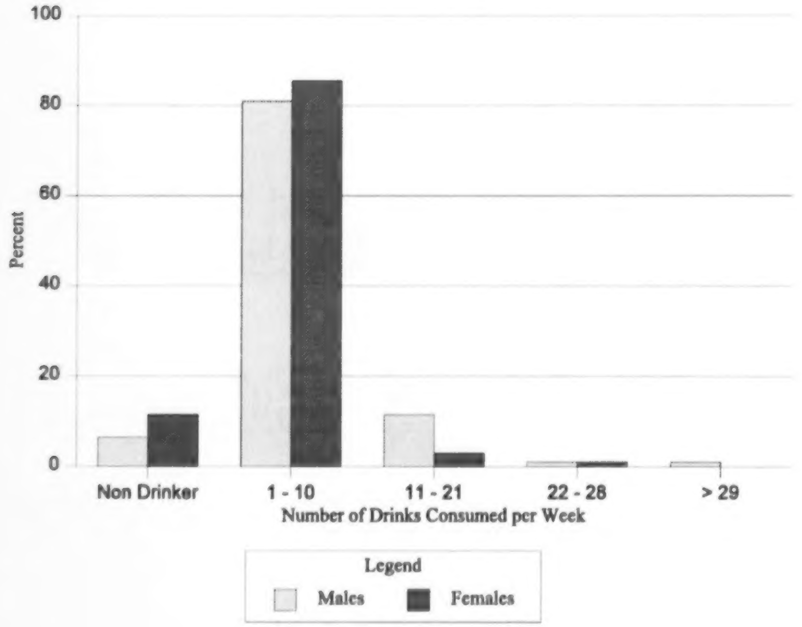
Figure 4.13 **Changes in the Proportion of Employees who Smoked among Fitness and Lifestyle Program Members between 1981-1985 and 1986-1990**



4.5.5.2 Alcohol Consumption

As Figure 4.14 illustrates, most employees in the fitness and lifestyle program were moderate in their consumption of alcohol, and approximately 10% (n = 310) reported being non-drinkers. On average, employees who used alcohol, consumed two beers, one shot of liquor, and/or one glass of wine per week. Approximately 8% (n = 223) of the employees who drank were at elevated risk of cirrhosis of the liver due to their increased weekly intake, consuming an average of more than eleven drinks per week (Health and Welfare Canada, 1990).

Figure 4.14 **Alcohol Consumption among Participants in the Fitness and Lifestyle Program by Number of Drinks Consumed per Week and Gender**



4.5.5.2a Gender and Alcohol Consumption

Females were more likely than males to be non-drinkers and among those that used alcohol, females were more likely than males to be moderate drinkers, though this gender difference disappeared when consumption exceeded 22 drinks per week. There was a significant gender difference in weekly alcohol consumption ($\chi^2 = 157.06$; $p<0.0005$), with males consuming approximately twice as many drinks per week. As a whole, neither group made any reduction in alcohol consumption as a result of program participation, but they did not consume an excessive amount to begin with. At pre-test, males consumed an average of 4.8 drinks per week, while females drank 2.6; well within the definition of moderate consumption (Health and Welfare Canada, 1990).

4.5.5.2b Participation and Alcohol Consumption

Length of participation had a significant overall effect on alcohol consumption ($\chi^2 = 14.05$; 4 DF; $p<0.0071$). Difference contrasts revealed a significantly higher ($\chi^2 = 5.38$; $p<0.0204$) consumption in members who had remained for two years in comparison to those who had been members for one year. Members who had remained for up to four years had similar drinking patterns, while those who had been members for five to ten years drank significantly more per week than the mean of all other years. However, the differences in both cases amounted to 1 drink per week.

Level of participation was significantly associated with alcohol consumption ($\chi^2 = 45.79$; 3 DF; $p<0.0005$). A greater proportion of non-active (NON) than REG and OCC employees were non-drinkers, and if they did drink, fewer consumed more than 11 drinks per week. Regularly active members of the fitness and lifestyle program consumed approximately one more alcoholic drink per week than OCC ($\chi^2 =17.97$; $p<0.0005$), and OCC drank significantly more than NON ($\chi^2 = 6.43$; $p<0.0112$). The DROP group drank significantly more than the NON group ($\chi^2 = 7.48$; $p=0.0063$), and significantly less than the REG group ($\chi^2 = 23.84$; $p<0.0005$). Combining the DROP group with the NON and REG groups did not alter the relationship of participation to alcohol consumption.

On average, following the first year of fitness and lifestyle program membership, alcohol consumption was reduced by over 3 drinks per week from 3.87 to 0.33, regardless of gender or level of participation. The average in all other years amounted to a reduction of only 0.3 drinks per week. In comparing the first five years with the second five years of program operation, participants consumed similar amounts of alcohol. In both cohort groups the vast majority were moderate or non-drinkers with only a small percentage (8% and 6%, respectively) at risk of cirrhosis due to excessive consumption.

4.5.5.3 Caffeine Consumption

The number of cups of coffee and/or tea consumed per day was significantly associated with gender (χ^2 = 10.95; p=0.0009). On average, males in the fitness and lifestyle program averaged 2.94 cups per day at pre-test, while females consumed an average of 2.62. Over the course of their program participation, females made a higher reduction in daily caffeine intake than males . However, the reduction averaged only 0.17 cups per day for females and 0.04 for males. As with alcohol, levels of caffeine consumption among the program participants was of no consequence in terms of health. The reductions associated with program participation, while in a positive direction in terms of health, were practically inconsequential.

Level and length of participation had no effect on the rate of caffeine consumption. The lack of any significant differences, therefore suggests that among the program members the consumption of coffee and tea was influenced entirely by gender.

4.5.5.4 Nutritional Habits

The Canada Food Guide stipulates the recommended number of food servings within and between the four food groups per day. Approximately 16% (n = 493) of the fitness and lifestyle program members were classified as high adherents of these recommendations. Almost twice as many scored low in adherence (n = 724), while the majority fell into the moderate category (n = 1,863), with an average score at pre-test of 16.58 ± 2.88 for all members.

The results of the overall 3 x 2 x 5 analysis of variance (ANOVA) revealed that gender and level of participation had significant effects associated with nutritional habits Table 4.11.

Table 4.11 Overall ANOVA Results of Changes in Nutritional Habits

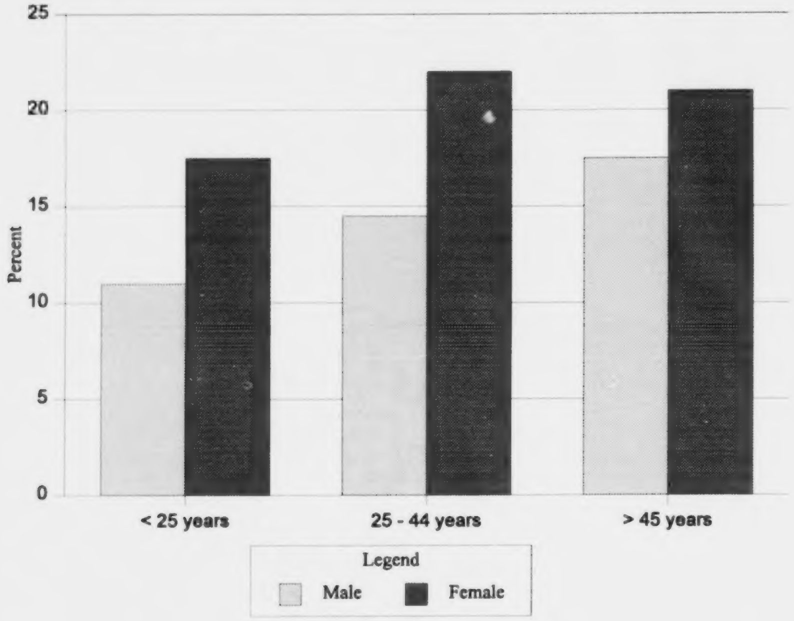
Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. of F
Within + Residual	11929.63	1707	6.99		
GENDER	143.71	1	143.71	20.56	0.000
LEVEL OF PARTIC.	367.79	2	183.89	26.31	0.000
LENGTH OF PARTIC.	14.31	4	3.58	0.51	0.727
Explained	577.37	7	82.48	11.80	0.000
Total	12507.00	1714	7.30		

4.5.5.4a Gender and Nutritional Habits

During the period of their membership, males and females demonstrated significant differences in their nutritional habits (F = 20.56; $p<0.0005$). A greater proportion of females than males displayed high adherence (score 20-25) to the guidelines for sensible eating at all age groups, though the difference declined with age. With increasing age, high adherence to Canada's Food Guide became more common in both genders (Figure 4.15).

Over the course of their membership, females scored 1-point higher, while males achieved only a 0.32-point improvement. In both cases the scores at pre-test and post-test fell within the "moderate" range of adherence to Canada's Food Guide.

Figure 4.15 High Adherence to Canada's Food Guide Among Participants of the Fitness and Lifestyle Program by Age and Gender



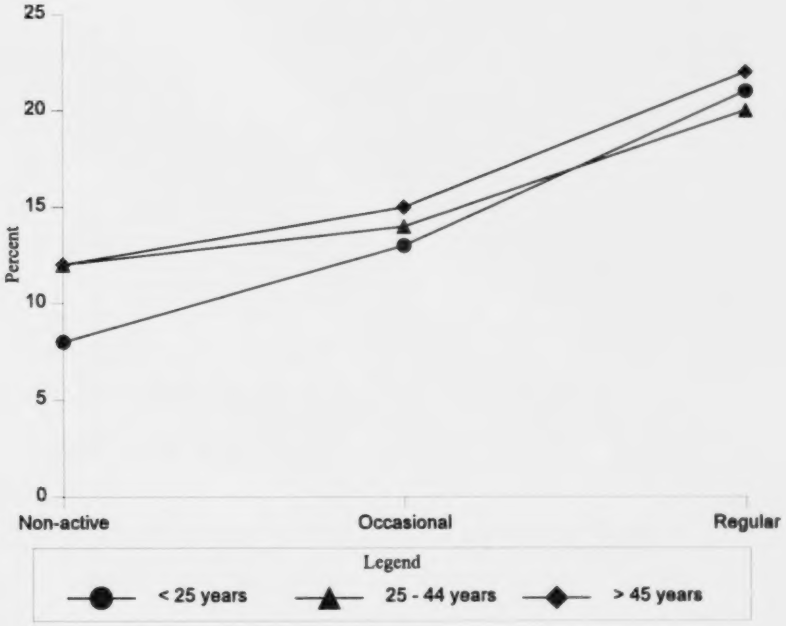
4.5.5.4b Participation and Nutritional Habits

Significant differences existed between the various levels of participation and nutritional habits (*F* = 16.41; 3 DF; $p<0.0005$). Regularly active employees were most likely to be high adherents to Canada's Food Guide and non-active employees least likely. This was true regardless of gender and age group (Figure 4.16).

Level of participation had significantly different effects on changes in nutritional habits. Utilizing Helmert contrasts, the NON group demonstrated a significantly smaller improvement than the OCC and REG groups combined ($t = -6.04$; $p<0.0005$), and the OCC group a significantly smaller improvement than the REG group ($t = -3.66$: $p=0.0003$). Level of participation, therefore has a gradient effect on improving nutritional habits; greater improvements are experienced with a higher level of participation. However, from a practical standpoint, the scores ranged only within the "moderate" category at pre-test and post-test.

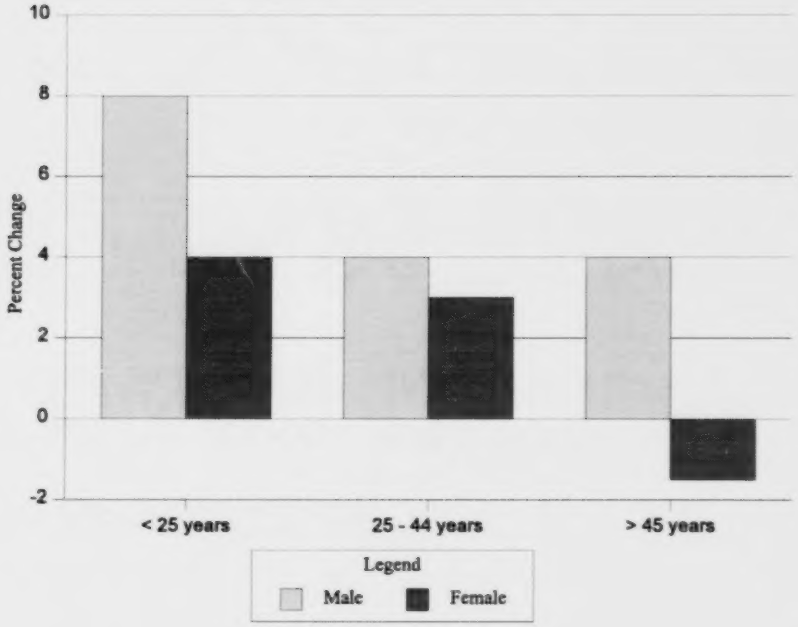
The DROP group demonstrated an average score of 16.62 at pre-test. In combining the DROP group with the NON and REG groups in two further analyses, the gradient effect of level of participation was changed when DROP was combined with REG. Helmert contrasts failed to demonstrate a significant difference between OCC and mean (REG,DROP). Inasmuch, the pre-test nutritional habits of the DROP group may have biased the original gradient effect.

Figure 4.16 **High Adherence to Canada's Food Guide Among Participants of the Fitness and Lifestyle Program by Participation Level and Age**



In comparing the first five years of the fitness and lifestyle program to the second, employees demonstrated small but positive changes to high adherence of Canada's Food Guide. Males were more likely to change their nutritional practices in a healthy fashion at all age groups. However, both genders changed in a positive direction, with the exception of females over age 45, who demonstrated a small, but negative changes (Figure 4.17).

Figure 4.17 **Net Changes in High Adherence to Canada's Food Guide among Fitness and Lifestyle Program Participants by Age and Gender between 1981-1985 and 1986-1990**



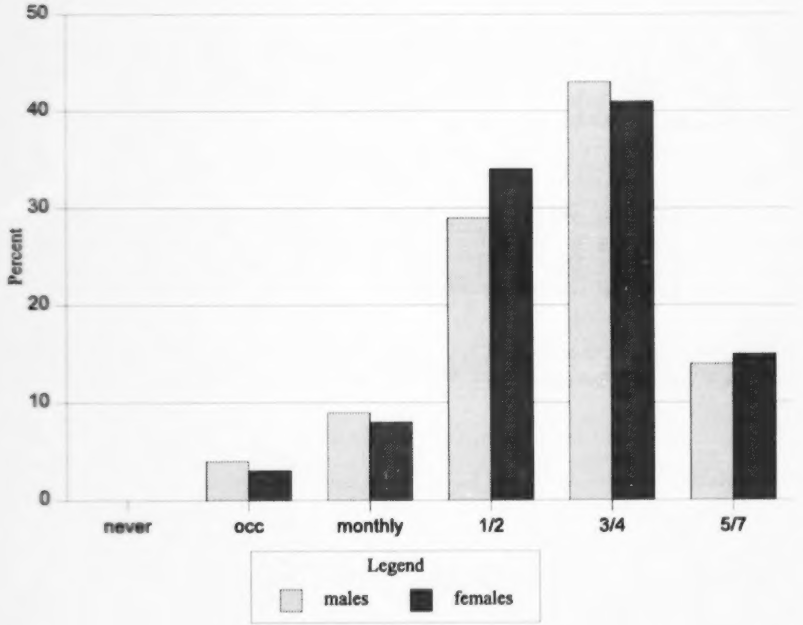
4.5.5.5 Leisure Time Physical Activity

As Figure 4.18 illustrates, approximately 88% (n = 2,710) of the fitness and lifestyle program membership reported being physically active in their leisure time on at least one occasion per week. This was true, regardless of gender or age.

4..5.5.5a Gender and Leisure Time Physical Activity

Males and females reported significantly different frequencies of leisure time physical activity ($\chi^2 = 85.34$; 5 DF; $p<0.0005$). A greater proportion of males than females reported being active in their leisure time three or four times a week, while more females than males reported being active once or twice a week during their leisure hours.

Figure 4.18 Frequency of Leisure Time Physical Activity among Fitness and Lifestyle Program Participants by Gender



4.5.5.5b Participation and Leisure Time Physical Activity

Length of participation in the fitness and lifestyle program was unrelated to the reported frequency of leisure time physical activity. Regardless of the length of membership, participants reported similar frequencies of leisure time physical activity.

There was a significant relationship between reported leisure time physical activity and level of participation ($\chi^2 = 57.21$; 15 DF; $p<0.0005$). Those who reported higher frequency of leisure time physical activity (>3/week) were more likely to be program dropouts (DROP). Conversely, those who reported less than 1 leisure time activity per week were more likely to be in the regularly active group (REG). Being active once or twice a week was associated equally with level of participation in the fitness and lifestyle program.

The OCC and NON groups were significantly more likely than the REG group to report higher rates of leisure time physical activity ($\chi^2 = 8.33$; $p=0.0039$), but showed no differences between them. In Helmert contrasts to determine the effects of the DROP group, there was a significant difference between the OCC and mean(NON, DROP) groups as well as between REG and mean(OCC, NON, DROP) ($\chi^2 =5.73$; $p=0.0167$).

Increases in leisure time physical activity were dependent on level of program participation. The NON group showed the largest effect. A majority of non-active participants reported leisure time physical activity on an occasional basis at pre-test. At post-test the same group had a majority who reported being active once or twice a week during leisure time. The OCC group reported once or twice a week at pre-test and three or four times a week at post-test. The REG group reported monthly to once or twice a week at both pre-test and post-test. The DROP group, who reported significantly higher frequency of leisure time physical activity at pre-test, may have dropped out of the fitness and lifestyle program because of a desire or ability to continue regular physical activity outside of the workplace program.

In summary, participation in the fitness and lifestyle program was associated with changes in lifestyle behaviours that would be considered positive in terms of health, regardless of gender, length or level of participation. Females, with the exception of nutritional practices, demonstrated less healthy lifestyle behaviours at pre-test. Their participation in the fitness and lifestyle program, however, resulted in greater changes in lifestyle behaviours than in males, so that at post-test the gender differences were reduced.

Participation in the fitness and lifestyle program on a regular (REG) basis (3 to 7 times per week) was associated with healthier lifestyle behaviours when compared to occasional (OCC) or non-active (NON) participants. This relationship was true at both pre-test and pos-test. Participation in the fitness and lifestyle program had the largest positive effect in the OCC group followed by the REG and NON groups. It is interesting to note that the NON group, who maintained a membership but did not use the facility, also made positive changes in lifestyle behaviours, suggesting that general promotional efforts towards healthy lifestyles at Esso, or in the community at large, were effective.

Finally, while the effects were generally small, during the ten years of operation, participants in the fitness and lifestyle program demonstrated positive changes in lifestyle behaviours that resulted in a greater proportion becoming non-smokers (6%), moderate drinkers (1%), active leisure time participants (4%) and more healthy eaters (3%).

4.5.6 Changes in Health Status Following Participation in the Fitness and Lifestyle Program

Four measures of self-rated health status were assessed for their association with participation in the fitness and lifestyle program; all ordinal in nature. The variables included: self-rated health status; self-rated physical fitness; work-related stress; and, work-related physical activity. Each dependent measure was analyzed in a 3 x 2 x 5 (Group x Gender x Length of Membership) Kruskall-Wallis (1952) one-way analysis of variance by ranks. Each analysis was repeated three times to evaluate the effect of the program dropouts, as previously discussed.

The source of any significant effect of the length of participation was determined by conducting a series of difference contrasts where each category of length of participation was compared to the average effect of previous lengths of participation.

Each analysis was repeated three times in order to evaluate the effect of the program dropouts. The source of any significant effect of level of participation was determined by establishing a series of contrasts. Firstly, simple contrasts to determine if the DROP group differed from the other groups were completed. Secondly, the NON, OCC and REG groups were compared, and finally, the DROP was recombined with the NON and REG groups to conduct two comparisons to determine the effect of the dropouts.

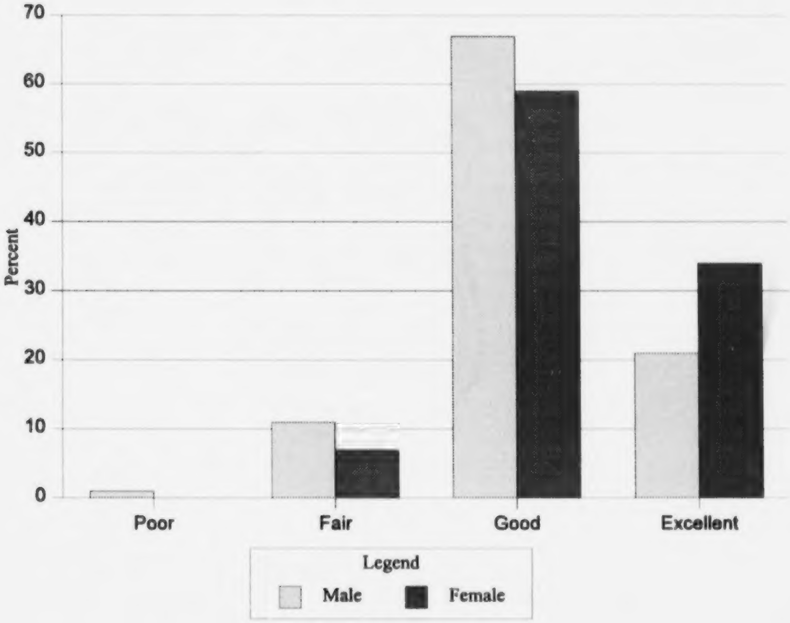
4.5.6.1 Self-rated Health Status

Thirty percent (n = 933) of fitness centre members rated their overall health as excellent, and a little over a half (1,765) regarded their health as good. Approximately 11% (n = 357) said their health was fair, while only 25 participants (0.08%) regarded their health as poor.

5.5.6.1a Gender and Self-rated Health Status

There was a significant difference between males and females in self-rated health status (χ^2 = 4.46; p=0.0347), which was dependent on age. In employees over age 45 a larger proportion of males rated their health as good, while a greater number of female participants rated their health as excellent (Figure 4.19). Employees under age 44, displayed similar ratings of health regardless of age and gender.

Figure 4.19 Self-rated Health Status among Fitness and Lifestyle Program Participants over Age 45 years by Gender



4.5.6.1b Participation and Self-rated Health Status

Length of participation in the fitness and lifestyle program had a significant effect on self-rated health status ($\chi^2 = 49.85$; 4 DF; $p<0.0005$) which was true regardless of gender and age. In difference contrasts to determine the source of the effect, a weak linear relationship emerged with the exception of the effect of the first year. Self-rated health status was significantly higher following five to ten years than the mean of all previous years ($\chi^2 = 22.25$; $p<0.0005$), and the effect of four years was significantly higher than the mean of the first three years ($\chi^2 = 10.99$; p=0.0009). Year 3 had a larger average rank than the mean of the first two years (n.s.), but the effect of the first year of participation on self-rated health status was significantly higher than the mean of the first 2 years of participation ($\chi^2 = 15.92$; p=0.0001). It appears that the first year of participation was associated with significant increases in self-rated health status, which remained fairly constant until at least four years of continued membership had passed.

There was a significant linear relationship between self-rated health status and level of participation in the fitness and lifestyle program (Figure 4.20). Regularly active employees rated their health higher than the occasionally active ($\chi^2 = 63.67$; p<0.0005), who in turn rated their health higher than the non-active group ($\chi^2 = 29.28$;p<0.0005). This relationship was true regardless of gender or age-group.

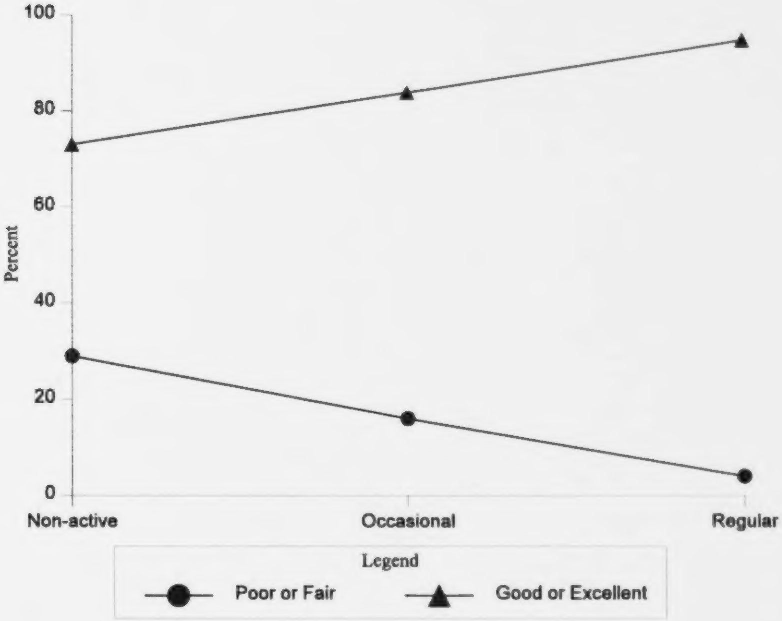
The majority of the DROP group rated their health status as good at the pre-test, which was significantly higher than the NON ($\chi^2 = 38.13$; p<0.0005) group, but lower than the REG group ($\chi^2 = 100.74$; p<0.0005). There was no difference in self-rated health status between the DROP and OCC groups. Combining the DROP and NON groups and comparing them with OCC, masked the previous significant difference between NON and OCC. The significant difference between REG and the other groups remained when DROP was combined ($\chi^2 = 31.32$; p<0.0005).

The magnitude of change in self-rated health status in all participation groups was small. Even the oldest regularly active females who had been members for five to ten years demonstrated small changes equivalent to moving from good to excellent, and in comparing the first five years of the fitness and lifestyle program with the second, the proportion of employees in each of the categories of self-rated health status remained fairly constant. This is reflective of the biased population in the current study, who are all members of the fitness and lifestyle program.

4.5.6.2 Self-rated Physical Fitness

On average, one-half of all employees who were members of the fitness and lifestyle program rated their personal fitness level as good or excellent (n = 1,490), 38% (n = 1,170) said they had a fair level of fitness, while 12% (n = 420) assessed their personal fitness levels as poor.

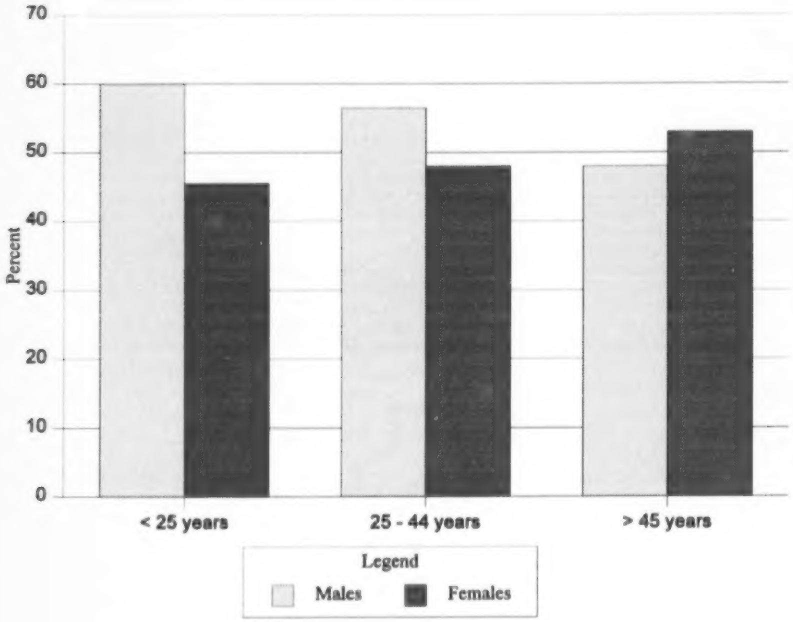
Figure 4.20 **Self-rated Health Status among Fitness and Lifestyle Program Participants by Level of Participation**



4.5.6.2a Gender and Self-rated Physical Fitness

Males and females differed significantly in their self assessment of physical fitness ($\chi^2 = 31.32$; $p<0.0005$). A significantly greater proportion of males than females under the age of 45 rated their personal fitness as good or excellent. The situation changed in the over 45 year-olds, where females demonstrated a 5% greater proportion than males who rated themselves as good or excellent (Figure 4.21). Regardless of age, a 5% greater proportion of females than males rated themselves as having poor fitness levels.

Figure 4.21 **Fitness and Lifestyle Program participants who rated their Fitness as Good or Excellent by Age and Gender**

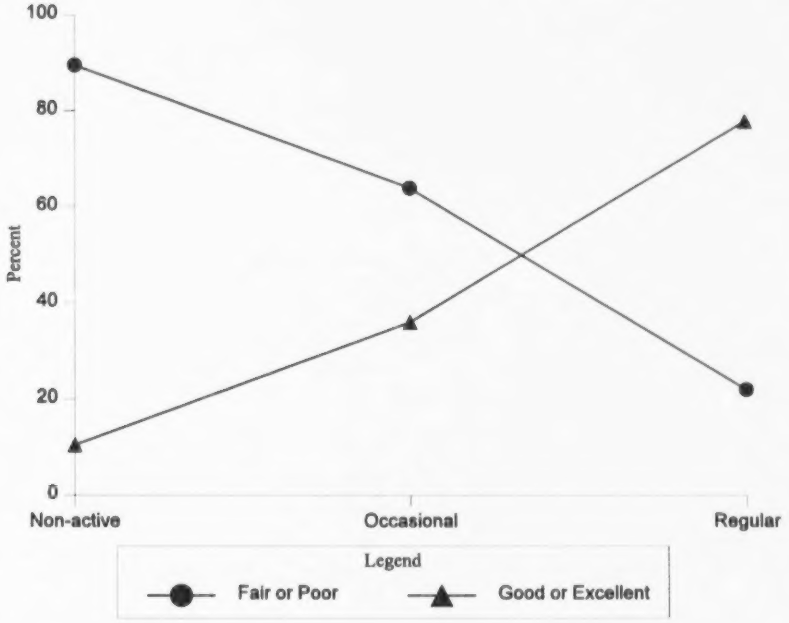


4.5.6.2b Participation and Self-rated Physical Fitness

A significant linear relationship between length of participation and self-rated physical fitness was observed (χ^2 = 107.13; 4 DF; p<0.0005). Significant differences were observed in all contrasts, demonstrating that self-rated physical fitness improved as length of time in the fitness and lifestyle program increased. This relationship was true, regardless of age, gender or participation level.

Level of participation had a significant effect on self-rated fitness (χ^2 = 523.86; 3 DF; p<0.0005). Figure 4.22 illustrates that regardless of gender or age, REG employees rated their fitness higher than OCC (χ^2 = 215.11; p<0.0005), who in turn rated their fitness higher than the NON (χ^2 = 139.50; p<0.0005).

Figure 4.22 **Self-rated Physical Fitness among Participants in the Fitness and Lifestyle Program by Level of Participation**



The DROP group rated their pre-test physical fitness significantly higher than the NON group ($\chi^2 = 145.23$; $p<0.0005$), but significantly lower than the REG group ($\chi^2 = 218.62$; $p<0.0005$). The DROP and OCC groups were similar in their self assessments of physical fitness. However, Helmert contrasts revealed no effect in combing the DROP group with NON or REG; the previous linear relationship remained.

The effects of participation on self-rated physical fitness were generally small. The greatest changes were associated with a majority of OCC group females who increased their self assessment from fair to good. Over the ten years of fitness and lifestyle program operation, self-rated fitness remained fairly constant among all participants.

4.5.6.3 Work-related Stress

Almost 40% (n = 1,232) of the fitness and lifestyle program members reported that their jobs were always or frequently stressful. An additional 48% (n = 1,478) said their work was occasionally stressful, and only 12% (370) were seldom or never troubled by work-related stress.

4.5.6.3a Gender and Work-related Stress

Significant differences between males and females on the degree of perceived work-related stress were evident ($\chi^2 = 80.56$; $p<0.0005$). A greater proportion of males than females over age 25 reported that their work was always or frequently stressful. There were no differences, however, between male and female employees in the youngest age-group. Work-related stress was also associated with age; the proportion of employees who reported that their jobs were always or frequently stressful, increased after age 25 (Figure 4.23).

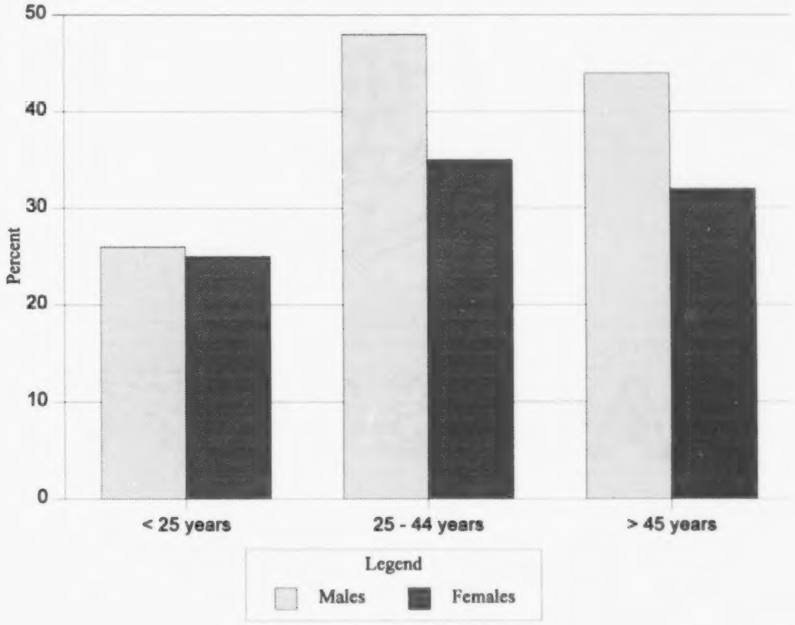
4.5.6.3b Participation and Work-related Stress

Length of membership was significantly associated with perceptions of work-related stress ($\chi^2 = 21.82$; 4 DF; $p=0.0002$). Difference contrasts revealed significantly higher stress in members of five to ten years in comparison to the mean of all other years ($\chi^2 = 6.49$; $p=0.0109$), and the linear association was significant with the exception that four year members rated work stress no differently than members with three or fewer years in the fitness and lifestyle program.

There was little systematic relationship between level of participation in the fitness and lifestyle program and the perception of stressful work. An equal proportion of REG, NON and OCC employees judged their work as always or frequently stressful. A significantly smaller proportion of employees in the DROP group than the NON ($\chi^2 = 5.57$; $p=0.0183$), OCC ($\chi^2 = 13.38$; $p=0.0003$)and REG ($\chi^2 = 13.41$; $p=0.0003$) rated their work as always or frequently stressful. The consequence of combining DROP with NON and REG did not alter the relationship of the participant groups, suggesting a significant difference in perceived work stress among all who remained active in the program.

Regardless of gender, length or level of participation, employees experienced an increase in work-related stress while they were members of the fitness and lifestyle program. This was particularly reflected in employees over age 45 years who reported an average 10% (n = 308) increase in the proportion of employees who rated their work as always or frequently stressful between 1981-85 and 1986-90.

Figure 4.23 **Fitness and Lifestyle Program Participants who are Always or Frequently subject to Work-related Stress by Age and Gender**



4.5.6.4 Work-related Physical Activity

Approximately 40% (n = 1,232) of the employees in the fitness and lifestyle program classified their work as sedentary, and almost the same number said their work could be described as light (n = 1,170). Those describing their work as active amounted to 17% (n = 524), and only 5% (n = 154)) reported very active occupational activity.

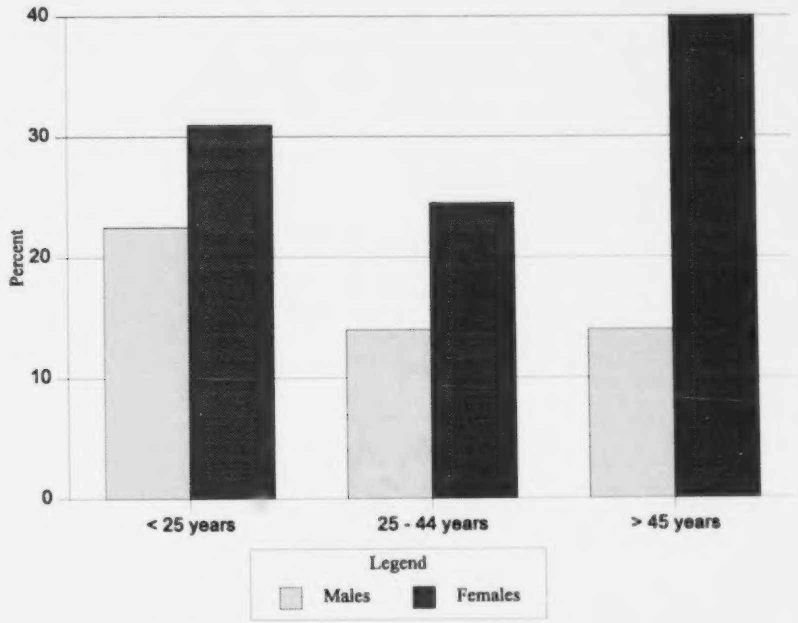
4.5.6.4a Gender and Work-related Physical Activity

A significantly greater proportion of females than males reported their work as active or very active at all age categories ($\chi^2 = 21.61$; 3 DF; $p<0.0005$) with the largest difference displayed in employees over age 45 years (Figure 5.21). Conversely, a 20% greater proportion of males than females classified their work as sedentary.

4.5.6.4b Participation and Work-related Physical Activity

There were no significant differences in perceived work-related physical activity associated with either length or level of participation in the fitness and lifestyle program. Equal proportions of employees classified as NON, OCC and REG rated their jobs as sedentary or active. The DROP group were similar to all other employees, and the effect of participation resulted in no changes in how employees rated their work. Over the ten years of operation of the program, employees displayed similar assessments relative to work-related physical activity. The gender differences displayed in Figure 4.24 were similar in both five-year cohorts.

Figure 4.24 Fitness and Lifestyle Program Participants who rated their Work as Active or Very Active by Age and Gender



4.6 DISCUSSION

4.6.1 Participation Rates

A key factor in the success of any fitness and lifestyle program is the sustained participation rate. A wide variety of techniques were used to develop and sustain employee motivation at Esso. In addition to on-site facilities, supplied clothing and laundry services, an hour per day paid time to participate, extended hours of operation, and a wide variety of physical activities, program managers also installed bulletin boards in high traffic areas, held health education seminar series, and involved employees in a worksite committee to determine future fitness and lifestyle programming needs. Fitness and lifestyle literature and information was available from the fitness centre, staff offered individual lifestyle counseling, and program attendance was recognized through tokens such as t-shirts.

Previous research has generally reported participation rates of approximately 20% in worksite fitness and lifestyle programs, and of those initially recruited approximately half become long-term program participants (Shephard, 1989). At General Foods (Shephard, 1982; Morgan, et al., 1984), approximately 22% of head-office employees with ready access to the facility, and 13% of all eligible employees registered in the workplace fitness program. A follow up study at 20 months revealed that 53% of the males and 62% of the females were still regularly active in the program. Similarly, at Exxon, 65% of the executives who joined the fitness program were still active two or more times per week one year later (Yarvote, et al., 1974), while at NASA only 38% continued to be active two or more days per week after the first year of membership (Durbeck, et al., 1972).

The landmark Canada Life Study (Cox, et al., 1981; Song, et al., 1982), reported initial participation rates of approximately 50% of eligible employees. Following the first six months of program operation, 80% of these employees were still participating, and a further follow up at 18 months revealed sustained participation by 46% of the group. Many of the employees who dropped out of the program reported that they were continuing physical activity in their home communities.

In the current study, approximately 34% of the total annual workforce purchased memberships in the fitness and lifestyle program. Of these, 17% dropped out within their first year, leaving 83% of the initial membership participating at least one year. Close inspection of the data reveal, however, that despite maintaining a membership, approximately 12% reported being non-active and a further 39% were occasionally active, attending the program less than twice a week. A total of 49% of the initial membership continued to attend the program at least twice a week.

Over the ten years of programming, annual participation rates remained fairly constant. However, a large number of employees left the program and/or organization and new employees joined. Continuous membership in the program declined rapidly from year to year with a very small percentage (1.2%) still participating after ten years. Among this group, the propensity to change levels of participation was also extremely high. Employees who were regularly active in one year were as likely to report non-activity or occasional activity in the following year. With such high attrition rates and the propensity to change levels of activity, meaningful longitudinal assessment and interpretation was impossible.

Employee participation in the Esso program between 1981 and 1990 was similar to previously reported participation rates for workplace fitness and lifestyle initiatives. While the annual rate of membership was somewhat higher at 34%, the proportion of employees who were active at least twice a week in the program was somewhat lower ranging between 25% and 53%. An encouraging finding among the employees who dropped out of the program, was an increased level of leisure time physical activity when compared to program members. It would appear, therefore, that dropping out of the program was a purposeful move on behalf of this group of employees to engage in activity outside of the fitness centre, possibly because their interests extended to activities that were not provided through the workplace program.

The employees who took out membership yet reported no activity raise questions as to the motivation for enrolling in the fitness and lifestyle program. This group of employees continued to maintain membership, pay monthly dues through payroll deduction, engage in annual assessments and yet reported no activity in the fitness centre. This group also reported minimal amounts of leisure time physical activity at pre-test and post-test assessments. Physical activity or fitness, *per se*, were apparently not the motivation for membership among these employees.

The opportunity for employees to receive a comprehensive annual assessment of fitness and health may have been sufficient reason for this group to maintain membership. Alternatively, the non-active group may have been "full of good intentions" yet unable to act on them for a variety of reasons. Finally, the motivation may have come from some desire on the part of these employees to be seen to be supportive of this particular company initiative. The fitness and lifestyle program at Esso is supported wholeheartedly by the senior management, and is promoted as a desirable part of the corporate culture. Non-active employees may have felt it was important to be associated with the program because of its high profile in the organization. In so doing, there may have been perceived gains unrelated to physical activity and fitness that this group of employees felt they accrued. Research to determine the motivation for continued membership in the fitness program, other than involvement in physical activity and improvements in physical fitness, is warranted. Further, the factors that lead to changes in level of activity, particularly those that result in decreases or cessation of activity, are important questions for continued study.

4.6.2 Fitness Measures

As a consequence of program participation, changes in fitness levels in both males and females, regardless of level and length of participation, were significant and in a direction that is considered positive from a fitness and health standpoint. However, the effect sizes were very small and in practical terms were inconsequential, failing on the whole, to move participants beyond the "average" category of the normative data for Canadians (Canada Fitness Survey, 1981). For example, the most significant improvement was an increase of only 3.4 situps that females were able to perform in one minute.

In comparison to Canadian normative information, as a group, the non-active employees ranged between the "poor" and the "below average" categories, the occasionally active between the "below average" and "average", and the regularly active in the "average" category on fitness measures at pre-test and post-test. While the results support a significant linear relationship between level of participation and fitness, and the direction of change in fitness measures in the active groups is positive and supports previous research regarding the frequency of exercise required to maintain and achieve improved fitness (Mathews & Fox, 1971; Astrand & Rodahl, 1977), the magnitude of the changes are minimal and inconsequential from a practical viewpoint. From a fitness improvement point of view, the best that can be stated is that program participation appeared to provide a successful means whereby employees who were active, either regularly or occasionally, were able to maintain and possibly achieve some average level of fitness.

It might be argued that over the ten years, participation in the fitness and lifestyle program also provided members with some "protection" from the normal rate of decline in physical capacity associated with increasing age. It is generally accepted that a 1% per year decline in functional capacity, as measured by 18 different functions (Orban, 1994), occurs after age 20. The fact that, on average, employees maintained and improved fitness, even minimally, during their period of membership may lend support to a "protective" mechanism. The positive benefits of physical activity are well documented, and most evidence suggests a positive benefit on specific and general functions of the participant (Astrand, 1986), which results in an increased age-related functional capacity. This, in turn, protects the individual from chronic diseases and allows an improved quality of life.

Participation in the fitness and lifestyle program was associated with only minimal changes in predicted maximal oxygen uptake. However, significant reductions in the proportion of employees at health risk due to obesity were observed over the ten years of program operation. On average, the segment of employees at risk was reduced by 10%, regardless of the obesity indicator used. This is in stark contrast with recent investigations which have reported data showing secular trends towards increasing fatness among Canadians (Health and Welfare Canada, 1993).

Obesity was also significantly related to the level of program participation. A graded response showed that NON were more obese than OCC, who were, in turn, more obese than REG. This has important implications for workplace fitness and lifestyle programmers. Even motivating someone to become physically active on an occasional basis (monthly to twice per week) appears to have significant benefits from health and functional perspectives. This is consistent with the review by Blair, et al. (1994), who have discussed the positive health benefits of low-intensity activity, particularly as it relates to reduced risk of CHD. From the studies reviewed, they concluded confidence in the relationship between sedentary living, obesity and increased risk of CHD, which was reduced with even occasional levels of physical activity.

4.6.3 Lifestyle Behaviours

In addition to a maintaining fitness and reducing age-related functional decline, participation in the program may have resulted in a more generalized health benefit as evidenced by changes in health-related lifestyle behaviours and self-ratings of health status. Previous research has noted that participation in physical activity acts as an entry point to reflect on health-related behaviour practices creating a ripple effect to other areas of lifestyle behaviours (O'Hagan, 1984; Shewstowsky, 1983).

The health hazards of smoking were suspected soon after the tobacco leaf was introduced to Europe from America. The prudent James I of England (1566-1625) described the odious habit as,

> "a branch of the sin of drunkenness, which is the root of all sins, and a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fume thereof, nearest resembling the horrible Stygian smoke of the pit that is bottomless."

Studies that have investigated smoking in relation to physical activity have been most recently reviewed by Wankel & Sefton (1994), who concluded a consistent negative association between involvement in regular physical activity and smoking. The authors note a change in the strength of the negative relationship over time. Earlier studies (Blair, et al., 1985; Blair, et al., 1988; Shephard, 1989), reported a consistent negative, but weak association, while more recent population surveys in Canada (Stephens & Craig, 1990) and the United States (Revicki, et al., 1991) have shown a much stronger inverse relationship between activity and smoking. Stephens & Craig (1990), suggest this is evidence that lifestyle practices that support good health are becoming generally more consistent. The current study found a significant inverse linear relationship between level of activity and smoking. Regularly active employees smoked less than occasionally active, who in turn, smoked less that non-active members.

The prevalence of smoking reported in the current population is lower than that reported for the Canadian population in 1988 (28%) (Stephens & Craig, 1990). This can be explained by the fact that the current population were all members of an employee fitness and lifestyle program, and were well educated. It would therefore be expected that this group would demonstrate a lower prevalence of smoking than the general populous (Marti, et al., 1988; Blair, et al., 1985, 1990; Stephens & Craig, 1990).

The findings from the current study with respect to gender differences are in opposition to the findings of the Campbell's Survey, which determined that more men than women were smokers. In members of the Esso program, females were more likely than males to be current smokers at all age groups, though the difference was greatest among employees under 25 years old. This difference is explained by a higher proportion of regularly active males than females in the program and the previously reported inverse relationship between smoking and activity level. The proportion of employees who reported having never smoked was higher than that reported for the Canadian population in general (Stephens & Craig, 1990). Again, this is reflective of this group of employees who were all members of the fitness and lifestyle program.

The proportion of smokers in the present study who reported quitting the habit was consistent with the segment of the Canadian population who reported quitting in the Campbell's Survey. In comparing data from the first five years of fitness centre operation with the second five years, the proportion of current smokers dropped by approximately 6%. These data are perhaps suggestive of the national trend toward smoking reduction over the last ten years, rather than any specific effect of activity or the fitness and lifestyle program on smoking cessation.

While smoking cessation campaigns and programs were offered at Esso, activity in the fitness centre as an integral component of these programs was encouraged, but not required. It is an interesting finding, therefore, that a somewhat greater proportion of smokers who quit were regularly active in the fitness program (6% more quitters were regularly active than non-active). However, of the studies reviewed by Wankel & Sefton (1994), there was insufficient evidence to suggest physical activity was a useful adjunct to smoking cessation programs. Further study is required to determine the efficacy of physical activity as an adjunct to smoking cessation initiatives.

Previous research has demonstrated a consistent nonsignificant relationship between physical activity and alcohol consumption (Wankel & Sefton, 1994). The current study found significant differences in alcohol consumption which were dependent upon, gender, level and length of participation in the fitness and lifestyle program. However, raw data revealed differences of one or two alcoholic beverages per week, all well below the current consideration of moderate consumption and, therefore of minimal health risk.

Patterns of alcohol consumption among Esso program participants were very similar to those reported for the Canadian population (Canada Health Survey, 1988). In that survey, the authors reported a somewhat larger segment of the population who were non-drinkers than in the current study (20% vs 10 %, respectively). However, the Canadian survey sample included all people over 15 years old. When the Esso program members, the majority of whom are over 20 years old, are compared to similar age cohorts, similar occupational and socio-economic strata from the Canadian study (Canada Health Survey, 1988), then they tend to be very similar in their patterns of alcohol consumption.

In their review, Wankel & Sefton (1994), postulated the need for a different measure of alcohol consumption. Currently, most research determines the number of drinks, or ounces of alcohol consumed per week. However, the negative health effects of alcohol are related more to heavy consumption per sitting, rather than weekly intake. Stephens (1986), reported a weak inverse relationship between physical activity and consuming four or more drinks at one sitting. This measure may be more sensitive to the deleterious health effects of drinking alcohol, and may lead to a greater understanding of physical activity as an adjunct to moderating and reducing alcohol consumption. Further study is recommended.

Nutritional assessments may be defined as the evaluation of the state of health resulting from the intake and utilization of nutrients (O'Donnell & Ainsworth, 1984). The basic objective of the nutritional assessment is to identify pertinent nutrition factors that may be improved or eliminated through education or intervention programs. The nutritional practices scale used in this study has been neither validated nor used previously, though it bears similarities to the composite scale developed in the Campbell's Survey on the Well-Being of Canadians (Stephens & Craig, 1990), and the United Kingdom Health and Lifestyle Survey (Blaxter, 1990).

The significantly greater proportion of females who displayed high adherence to Canada's Food Guide is contrary to the Campbell's Survey findings, where the authors reported no gender differences. This lower adherence by males at Esso should raise concerns, given their relatively higher risk to health due to obesity and high blood pressure, and suggests a need to consider targeted interventions for high risk groups. The positive linear association between good nutritional practices and physical activity is consistent with the results of previous research. Blair, et al. (1990), reported a positive relationship between level of activity and nutritional practices in clients assessed at the Cooper Clinic in Dallas. Blaxter's work in the United Kingdom Health and Lifestyle Survey (1990), found exercise and diet to be positively correlated, though she found some differences between males and females based upon social class.

Males were more likely than females to improve nutritional practices during their membership in the fitness and lifestyle program. With the exception of females over 45, however, all members showed improvements between the first and second five years of the program operation. The general trend in positive changes toward more healthful nutritional practices reported here is desirable. Whether they are the result of participation in the fitness and lifestyle program, or an increasing public awareness of healthy lifestyles, which include sound nutritional practices, is unclear. The effect is more likely due to a general increase in health-promoting lifestyle behaviours which occur in concert when attention to, and change is made in any other(s).

Leisure time physical activity is one that is undertaken during an individual's discretionary time and that leads to a significant increase in caloric expenditure. Personal needs or choice dictate the type of activity and the motivation may be for fitness or health improvement, but may also be for numerous other reasons (Bouchard & Shephard, 1994). Most communities have seen systematic secular trends in leisure time physical activity and other aspects of personal lifestyle over the recent past. In addition, in urban North America, there has been a fitness boom throughout the seventies, followed by a plateauing of interest in physical activity. According to a recent national survey, approximately 11% of the Canadian population are physically active at an intense and regular enough rate to produce cardiovascular fitness improvements; and another 40% are active enough to produce at least some positive health benefit (Stephens & Craig, 1990).

Some 88% of the employees in the fitness and lifestyle program at Esso reported being active during their leisure hours at least once a week. However, within this group significant differences were observed and were dependent upon gender and level of participation. Males reported significantly more leisure time activity than females, which is in agreement with previous findings (Stephens & Craig, 1990), for the period 1981 to 1988, when the proportion of men who were active grew more rapidly than women. The reasons for these gender differences are not clear, but may be related to the hypothesis that people who are less active during their leisure hours are more active at work. Females were significantly more likely than males to report their work as active or very active at all age categories, particularly in employees over age 45 years. The perception of the amount of occupational physical activity an individual endures, in this case, appears to support the hypothesis.

The scale used to classify work-related physical activity at Esso has not been validated, and all definitions are subjective evaluations by employees of the demands of their work. The headquarters of Esso Resources is a down-town office building, staffed by professionals, administrators, and support staff. The gender difference in perception of employees' demands of their work, may be genuine. The management, professional and technical employees constitutes 75% male employees, while the administrative group (support staff) is made up of 74% females. It may well be that the general requirements of support staff work involves more walking, lifting and carrying than the work of the management, professional and technical employees.

At Esso, dropping out of the fitness and lifestyle program was significantly related to increased leisure time physical activity. This is consistent with the findings of Song, et al. (1982), who reported dropouts from the Canada Life Study had done so to pursue exercise programs in their home communities. Those at Esso that discontinued their membership within the first year were significantly more likely to be active during discretionary time at least 3 times per week, when compared to those that were regularly active in the program. In fact, those employees who were regularly active reported significantly less leisure time activity than all other participant groups, reporting only occasional activity on leisure time. It would appear from these data that those who are active in the fitness and lifestyle program do not consider workplace fitness activity as leisure time activity, and engage in little additional activity beyond that completed in the workplace fitness centre.

In many workplace programs, involvement in the fitness centre occurs on the employee's personal time (before work, during lunch hour, immediately after work). At Esso however, the organization has a flexible work day policy and employees are free to go to the fitness centre at any time between 6:30 a.m. and 6:30 p.m. for up to one hour, which the company supports as part of the employee's work day. Employees who then take advantage of this benefit, and are only active in the workplace fitness centre, report minimal or no leisure time activity on the annual assessment questionnaire.

4.6.4. Health Status

There is an overriding belief that physical activity is good, not only as a means of improving physical fitness but also for the associated health benefits. The reported benefits include increased resistance to stress, both physical and emotional, and enhanced general well-being. Idler (1991), has reported that individual response to the simple question, "Is your health excellent, good, fair or poor" is a better predictor of longevity than even rigorous physical examination. Among a group of older adults, those reported to be comparable in health by physical examination were seven times more likely to die within the next 12 years if they rated their health as "poor" as compared to those who said they were in "excellent" health. For reasons that were not clear to Idler, people's perceptions of their health were strong indicators of longevity. In discussing the theories to explain these results, she suggested that there was a strong link between enhanced health and energy levels. Based on this concept, physical activity may augment overall health by contributing to an individual perception of increased energy and vitality.

The differences between males and females over age 45 in self-rated health status is consistent with the work of Idler (1991). She found men's perceptions of their health to be slightly better than women's, especially among men 45 to 64 years old. At Esso, men in this age group displayed increased hypertension, obesity and regular use of medication in comparison to women of the same age. As well, they rated their health somewhat less positively than females. That the rating was "good", may reflect the fact that they were members of the fitness and lifestyle program and as such also had a sense of increased energy and vitality which contributed to perceived health. Men and women in this age group also rated themselves similarly on levels of fitness, suggesting that among this age group health and fitness may be synonymous.

The linear relationships between level and length of participation in the program and self-rated health and fitness might be expected. Regular physical activity and self-rated health status are highly correlated (Belloc & Breslow, 1972; Idler, et al., 1991), therefore the relationship demonstrated in this study is not surprising. While, at first glance self-rated fitness level might be considered an entirely subjective measure, one must consider the present population. All are members of a fitness and lifestyle program who receive formal indication of their fitness level on an annual basis, and continual feedback through less formal means, such as personal heart-rate monitoring, timing, perceived exertion, etc. This population are acutely aware of changes in their fitness status, and are encouraged in personal monitoring as part of the program. The self-rating is likely an accurate assessment of changes in their fitness levels. In considering the objective measures of fitness, however, one is left to question the participants' high self-ratings of personal fitness. Perhaps even the smallest changes in measures of personal physical fitness equate to feelings of great accomplishment. Conversely, the self-rating may be much more a reflection of increased energy and vitality and not an accurate reflection of actual fitness levels. The question requires further research.

The perception of work-related stress is subjective, and varies between individuals depending upon perceived job demands, social support and degree of job control (Karasek & Theorell, 1990). The fact that over one-third of fitness centre members reported frequent or constant work stress is probably reflective of two situations. Firstly, the general circumstance in the oil industry during the eighties resulted in fluctuating prices and uncertainty regarding the viability and future of certain organizations. This situation may have led to worry and stress among employees about their future at Esso, rather than it being a commentary on the in-house corporate culture. This line of reasoning is further corroborated by the finding that all members of the fitness and lifestyle program experienced an increase in work-related stress between 1981-1985 and 1986-1990, a decade of great uncertainty for the oil industry.

A second line of reasoning follows the use of physical activity as a means of managing stress. At least one previous study has found that stress appears to be a major factor in determining participation in a health promotion program which included physical activity (Davis, et al., 1984). Physical activity might serve to reduce actual levels of physiological stress, and increased activity or the adoption of activity as a health habit might be an excellent method of controlling stress levels. In effect, the stressed employees joined the fitness centre as a method of stress management. However, there was no support for the hypothesis that active individuals are more stress-resistant than their inactive counterparts. At Esso it was the inactive group who displayed a 10% greater proportion who seldom or never experienced job stress. Rather, the finding suggests that a strong motivation for joining and engaging in the fitness and lifestyle program is, at least in part, as a method of managing the stresses of work.

A significantly greater proportion of the employees who dropped out of the fitness and lifestyle program reported their jobs as frequently or always stressful. While the motivations for dropping out of the program requires further study, it is possible that without a perception of work-related stress, the dropouts felt no need to remain in the program.

The gender differences in perceptions of work-related stress which are apparent in the present study are contrary to previous research, which found stress to be higher in female's work; attributed to reduced job control (Karasek & Theorell, 1990). It may well be, that in spite of the classification as support staff, females at Esso - who are generally well-educated - receive greater decision-making capacity over their work and thereby do not experience the work-related stresses of females in other worksites.

In summary, participation in the fitness and lifestyle program was associated with small positive changes in self-rated measures associated with health. The changes were dependent, however, on gender, age, length and level of participation. At pre-test, females rated themselves as more healthy and more active at work than males. Males, on the other hand, said they had higher work stress and were fitter than females. Participation in the fitness and lifestyle program resulted in greater positive changes in females than males, which were most noticeable in females over age 45 years.

Both level and length of participation in the fitness and lifestyle program demonstrated a linear relationship with increased self-rated health and fitness, which was evident at both pre-test and pos-test. Participation in the fitness and lifestyle program had the largest positive effect in the OCC and REG groups relative to self-rated health and fitness. The NON group made no changes in self-rated health or fitness as a result of membership. This is not surprising, as the NON group were inactive despite maintaining their membership.

The effects of participation in the fitness and lifestyle program on health-related measures were small. During the ten years of operation, participants displayed no changes in self-rated health, fitness or work-related physical activity. Work-related stress however, was increased, particularly among males over age 25 such that over the ten years of operation, participants reported a 10% increase in the proportion of employees who rated their work as always or frequently stressful. This result was probably due to the general situation of uncertainty in the oil industry during the eighties, and the fact that higher stressed people are generally more motivated to join fitness and lifestyle programs as a means of managing their stress.

4.7 CONCLUSIONS

During the period 1981 to 1990, participation in the fitness and lifestyle program at Esso Resources was associated with certain changes in fitness, lifestyle behaviours and health-related measures. The results, previously discussed, warrant the following eleven conclusions:

1. Participation rates in the fitness and lifestyle program at Esso Resources were similar to those previously reported for workplace programs. Dropout rates were also similar to those previously reported with many employees dropping out to pursue alternate physical activities on their leisure time.

2. A group of employees who were members of the fitness and lifestyle program reported no activity despite maintaining their membership, while many others reported changes in their level of activity from year to year. Further study is recommended to determine the motivations and/or circumstances that result in such high changes in level of activity, and why individuals maintain program membership, yet never utilize the programs and facilities.

3. Participation in the fitness and lifestyle program was associated with minimal improvements in physical fitness. It appears that among this group of employees, the program had the effect of maintaining average levels of fitness, perhaps through a possible "protection" from the functional decline normally associated with ageing.

4. Participation in the fitness and lifestyle program was associated with a decrease in health risk due to obesity. Those involved in physical activity, of even an occasional nature, displayed lower levels of obesity than non-participants. Further, during the ten year period of this study, the proportion of program participants at health risk due to obesity reduced by an average 10%. This is in stark contrast to Canadian population data for the same period, which indicated a secular trend to increased fatness.

5. The current study found an inverse linear relationship between smoking and level of activity, and a lower prevalence of smokers than reported for the Canadian population. The proportion of smokers who reported quitting the habit was similar to that of the Canadian population, suggesting a secular trend rather than any influence of the program. However, a greater proportion of employees who quit were regularly active in the program. Further study is required to determine the efficacy of physical activity as an adjunct to smoking cessation initiatives.

6. The significant differences in alcohol consumption which were associated with gender, level and length of participation could be explained by the large sample size. Members of the fitness and lifestyle program, as a whole, were moderate in their consumption of alcohol and at minimal health risk.

7. While males were more likely than females to improve nutritional practices during their membership in the fitness and lifestyle program, concern should still be given to improving males' nutritional practices, particularly those at higher health risk due to obesity and increased blood pressure. Initiatives targeted at higher risk males are recommended.

8. The finding that females reported significantly less leisure time physical activity than males is consistent with previous findings for the Canadian population, and may be related to the hypothesis that people whose work is more active are less active on their leisure hours. Females reported significantly higher work-related physical activity than males.

9. In members of the fitness and lifestyle program, self-rated health and fitness were associated with level and length of participation, which is consistent with previous findings. However, further study is required to determine the reasons for the relatively high self-ratings of health and fitness as compared to objective fitness measures.

10. Perceptions of work-related stress were associated with participation in the fitness and lifestyle program, possibly as a means of catharsis and stress management. However, there was no evidence to support the hypothesis that active individuals were more stress-resistant than their inactive counterparts. In the present study, non-active members and dropouts reported significantly less work-related stress than those who were occasionally or regularly active in the program.

11. Study 1 provides support, in part, for the Bouchard, et al. (1991), model linking physical activity, fitness and health. Further, the MANOVA and Kruskal-Wallis

techniques provide solutions for determining the multivariate relationships between physical activity as measured by workplace fitness and lifestyle program participation, physical fitness, lifestyle behaviours and health status. As with all empirical results, however, the degree to which they may be generalized to other employee groups depends in large part to the similarities or differences between employees, the organization in which they work, including the environment or corporate culture.

5. STUDY 2: THE RELATIONSHIP OF PHYSICAL ACTIVITY TO ILLNESS ABSENTEEISM

5.1 INTRODUCTION

Corporations have used a variety of reasons to justify the establishment of fitness and lifestyle programs. The principle ones have been that they will attract and retain employees, reduce health care costs, increase productivity and decrease absenteeism. There is some evidence that participation in workplace fitness and lifestyle programs is associated with reduced health care costs and increased productivity (Shephard, 1992). To date, the evidence regarding the association with rates of absenteeism is equivocal (see Chapter 2). Most authors cite the need for additional research, particularly of a longitudinal nature, to further clarify the relationship.

5.2 PURPOSE OF STUDY 2

The purpose of this study was to determine if level and length of participation in the workplace fitness and lifestyle program at Esso Resources was significantly related to rates of illness absenteeism.

5.3 STUDY DESIGN

Illness absenteeism, personal and demographic data were available for all employees from the Human Resources Department, Esso Resources, for the period 1986 to 1990. Included was information regarding: gender, date of birth, occupational classification, marital status, number of dependents under age six, years of post-secondary education, years of service and monthly income. In previous studies, all, or some of these characteristics have been shown to affect employee absenteeism, and were therefore controlled for in all analyses related to the dependent variable.

The effect of level and length of program participation on illness absenteeism was estimated by comparisons among program members and non-members following 1 to 5 years in which the fitness and lifestyle program was in operation at Esso Resources between 1986 and 1990.

5.4 DATA ANALYSIS

The study consisted of three related analyses which focused on the impact of program participation on rates of illness absenteeism. Factorial analysis of covariance (ANCOVA) was performed with the mean annual days absent due to illness as the dependent variable adjusted for age, gender, occupational classification, marital status, number of dependents, education and income.

Factor A (participation) was defined in three different ways depending upon membership and participation in the fitness and lifestyle program. The total employee population was first classified into non-members (NOMEM) and members of the fitness and lifestyle program. The members were further sub-divided based upon their level of participation in the program; non-participants (NON), occasional participants (OCC) and regular participants (REG) who had both pre- and post-tests. In addition, there were a number of employees who dropped out of the program within their first year of membership (DROP).

The reasons for dropping out of the fitness and lifestyle program were varied, and data from Study 1 indicates that a large proportion left the program to pursue other physical activities on their leisure time. Other employees in this group dropped out due to disinterest, illness, personal problems, leaving the company, belief that the annual reassessment was unnecessary, or other factors. Whatever the reason for dropping out of the fitness and lifestyle program, only those who remained employees of the organization, and therefore had pre- and post-test absence measures were retained in this analysis.

In one analysis the five groups (NOMEM, NON, OCC, REG and DROP) were compared. In another analysis, DROP was grouped with NON and compared with NOMEM, OCC and REG. Finally, DROP was combined with REG and compared to NOMEM, OCC and NON. The rationale for these regroupings was that the DROP group did not complete the entire first year of the fitness and lifestyle program and the possibility of them biasing the results was considered. Combining DROP with NON in one analysis and with REG in another, permitted a better understanding of how illness absenteeism was associated with program participation.

Factor B (length of membership) was divided into five levels, depending upon the number of years of program participation (1YR; 2YR; 3YR; 4YR; 5-10YR). In the case of the NOMEM group, length of employment at Esso was used as the equivalent measure to length of fitness and lifestyle program membership. This design resulted in three 4 x 5 factorial ANCOVA analyses of the illness absenteeism data, which were run utilizing the ANCOVA subroutine of the SAS statistical software package (Freund & Littell, 1981).

5.5 RESULTS

The purpose of study 2 was to determine if level and length of participation in the workplace fitness and lifestyle program at Esso was significantly related to illness absenteeism during the five-year period 1986 to 1990. In order to determine the significance of these relationships the study consisted of three related analyses.

Factorial analysis of covariance (ANCOVA) was performed with the mean annual days absent due to illness as the dependent variable adjusted for age, gender, occupational classification, marital status, number of dependent children under 6 years, education and income. Following initial inspection of the data, the dependent variable was highly non-normal. Therefore a log transformation, log (mean absence + 0.1), which produced a reasonable normal plot, was used as the dependent variable in the ANCOVA.

For employees who worked at Esso or were members of the fitness and lifestyle program in 1986, mean absence for that year was defined as the pre-test value. In the case of employees who joined the company or program in subsequent years, absence during the first year of employment or program membership was used as the pre-test value. Post-test values were computed as the mean value for all years following the first that the employee remained an employee or a member of the fitness and lifestyle program. Effect sizes were calculated using the following formula:

$$\frac{\text{mean (illness absence in year 1)} - \text{mean (illness absence in subsequent years)}}{\text{s.d. of mean (illness absence in year 1)}}$$

Table 5.1 presents the pre-test (mean illness absence in year 1), post-test (mean illness absence in subsequent years), difference scores and effect sizes for illness absence among employees at Esso between 1986 and 1990. As Table 5.1 indicates, the direction of change and the size of the effect differed depending upon whether gender, level and length of participation were used as the bivariate.

Upon inspection of the absence data, there were no differences between the NOMEM group and NON group in either mean pre-test, post-test annual absence or mean change in annual absence. Further, with the exception of a monthly payroll deduction for fitness and lifestyle program membership and the completion of the annual fitness assessment, NON was no different than NOMEM in their use of the fitness centre. For these reasons NOMEM were grouped with NON for purposes of the analysis of covariance (NON+NOMEM).

Table 5.1 **Pre-Test, Post-Test, Difference Scores and Effect Sizes for Illness Absence among Employees at Esso**

Employees (n = 1,530)		Pre-test	Post-test	Difference	Effect Size
Males		1.62 ± 7.80	1.49 ± 6.70	- 0.13	- 0.02
Females		3.60 ± 9.29	2.75 ± 9.10	- 0.85	- 0.03
Level of Participation					
Dropouts (DROP)		2.52 ± 7.87	3.00 ± 7.68	0.48	0.06
Non-active (NON)		2.55 ± 6.33	4.69 ± 7.12	2.14	0.34
Occasionally active (OCC)		3.16 ± 9.57	2.52 ± 9.21	- 1.36	- 0.07
Regularly active (REG)		2.37 ± 7.85	1.97 ± 8.06	- 0.57	- 0.05
Non-members		2.52 ± 6.31	4.68 ± 7.08	2.16	0.34
Length of Participation and/or Employment and Gender					
1 year	Males	1.80 ± 7.96	1.70 ± 7.89	- 0.10	- 0.01
	Females	3.94 ± 10.00	3.77 ± 7.79	- 0.17	- 0.02
2 years	Males	1.91 ± 6.29	1.71 ± 5.76	- 0.20	- 0.03
	Females	2.71 ± 5.01	2.47 ± 6.34	- 0.24	- 0.05
3 years	Males	2.67 ± 7.55	3.45 ± 6.89	0.78	0.10
	Females	4.15 ± 12.36	2.96 ±10.38	- 1.19	- 0.10
4 years	Males	1.91 ± 3.18	1.08 ± 3.10	- 0.83	- 0.26
	Females	3.59 ± 3.99	4.89 ± 4.54	1.30	0.33
5 years	Males	1.30 ± 2.90	0.94 ± 2.10	- 0.36	- 0.12
	Females	4.17 ± 8.34	4.24 ± 7.98	0.07	0.01

Three ANCOVA analyses were run. In the first analysis (NON+NOMEM), OCC, REG and DROP were compared. In the second, DROP was grouped with (NON+NOMEM) and compared with OCC and REG, and in the third, DROP was combined with REG and compared to OCC and (NON+NOMEM). The rationale for these regroupings was an acknowledgment of the possibility that the DROP group may have biased the results in some way.

5.5.1 Study 2 Population

Absenteeism data were available for a total of 1,597 employees who worked at Esso Resources Headquarters between 1986 and 1990. However, due to missing data in variables to be included in the analyses, complete data were available for a total of 1,530 employees (566 females and 964 males). These comprised 357 employees who were not members of the fitness and lifestyle program (NOMEM) and 1,173 who were (522 DROP, 367 REG, 193 OCC and 91 NON).

The 357 employees who were not members of the fitness and lifestyle program, for which complete data were available, represent approximately one-third of the total number of employees who worked at Esso during the period 1986 to 1990. The reasons for the limited availability of complete data are not clear. For some employees, employment at Esso was limited to less than 2 years. In this case, post-test absence data, by definition, was not available. In the case of other employees, the Human Resources department data was incomplete in the covariables to be included in this analysis. The potential, therefore, for bias to exist is acknowledged. However, it is assumed that employees with less than 2 years service, and employees for whom data was missing are random among the employee population. It is assumed, therefore, that the small number of non-member employees included in this analysis can be viewed as representative of the larger population of non-member employees in their demographic and absence data, and do not affect the results.

5.5.2 A Description of Illness Absence Among Esso Employees

In order to gain a greater understanding of illness absenteeism at Esso, a series of bivariate comparisons were computed which described the relationships among the variables of interest, and portrayed illness absence for the five-year period of interest. For the purposes of these descriptions illness absence was arbitrarily categorized into four levels: 0 days absent; 1-3 days absent; 4-15 days absent; and, 16+ days absent. The rationale for these groupings was as follows: zero days reflected no illness, or at least not sufficient to prevent attendance at work. One to three days reflects illnesses where a physician's note is generally not required to substantiate the absence. Four to fifteen days reflects the annual earned sick time at Esso, whereby an individual would suffer no wage loss for illness absence. Finally, illness absence of greater than 16 days would require some form of insurance such as Worker's Compensation or Short Term Disability in order to provide the employee with continued earnings. While this study did not attempt to determine an employee's motivation to work, work ethic or financial ability to remain absent from work, it is suggested that these categories are reasonable delineations of illness absence for the purposes of describing the situation at Esso during 1986 to 1990.

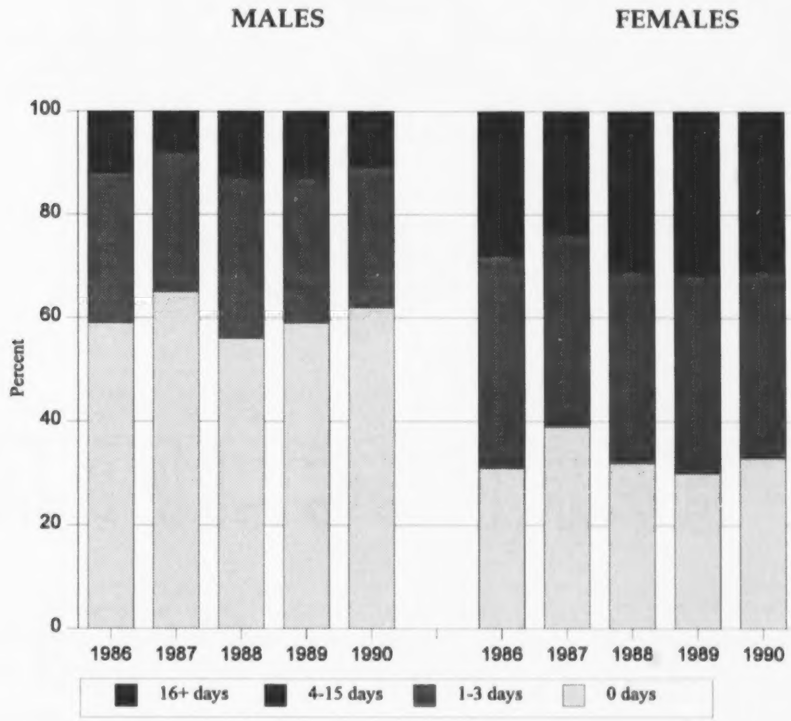
On average, annual days absent due to illness ranged from 0 to 199 days, with an annual average of 2.6 days. During the five-year period, almost half of the employees (n = 741) reported zero days absent due to personal illness. One-third (n = 495) reported absences between 1 to 3 days, while 16% (n = 245) were absent for 4 to 15 days. Only 49 employees were absent for 16 days or more. There were no significant differences between employees in the fitness and lifestyle program when compared to non-members.

5.5.2.1 Gender, Age and Illness Absence

Males and females differed significantly in annual illness absence ($\chi^2 = 933.56$; 3 DF; $p<0.0005$), though within each gender the use of sick time remained fairly constant from year to year (Figure 5.1). Females were more likely than males to be absent from work due to personal illness, regardless of the length of the absence; the largest difference occurring in absences ranging between 4 and 15 days, where females were 14% more likely to be absent. Conversely, over the five-year period almost two-thirds of the male employees reported zero days absent, as opposed to one-third of their female colleagues.

Within each gender, illness absence was significantly associated with age. In males under age 45, the proportion of employees reporting zero days absent was significantly greater than their older colleagues ($\chi^2 = 131.80$; 6 DF; $p<0.0005$). In females, employees over age 45 were no different than their younger colleagues in reporting zero days absent, but were significantly more likely to be absent for 16 or more days than their younger counterparts ($\chi^2 = 25.50$; 6 DF; $p=0.0001$).

Figure 5.1 **Annual Days Absent Due to Illness Among Esso Employees by Year and Gender**



5.5.2.2 Family Situation and Illness Absence

Marital status was significantly associated with illness absenteeism in both males and females. Males who were separated were almost half as likely to report zero days absent and almost twice as likely to be absent from work for between 1 to 3 days ($\chi^2 = 22.97$; 9 DF; $p=0.0063$). Females who were absent for more than 16 days were twice as likely to have experienced marital breakdown ($\chi^2 = 28.95$; 9 DF; p=0.0007).

In agreement with previous research, the current investigation showed a significant relationship between illness absence and the number of dependent children under age 6. Both males and females were likely to report increased absence associated with having young dependent children. In males, however, the significance was conditional on having four dependents. These men were then twice as likely as their colleagues to report absences of 4 to 15 days ($\chi^2 = 29.37$; 12 DF; p=0.0035).

5.5.2.3 Occupational Status and Illness Absence

Occupational status at Esso was reflected by: I) classification in either the management/professional/technical (MPT), or administrative (ADM) group, which was directly related to gender and years of post secondary education; and, ii) monthly salary which reflected occupational classification and length of service with the company. Previous research has demonstrated significant relationships between both occupation and years of service and absenteeism (see Reidy, 1990 for a review).

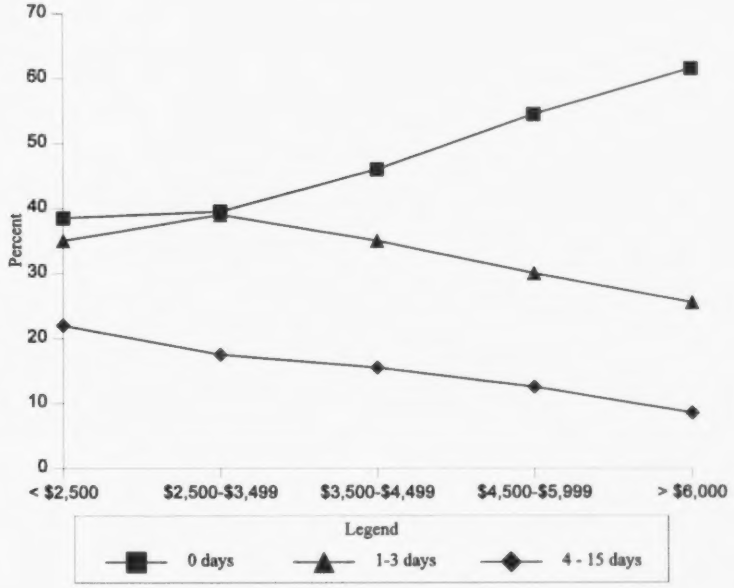
In the current study, females who reported zero days absent were more likely to be members of the MPT classification ($\chi^2 = 18.20$; 3 DF; p=0.0004), and had completed four or more years of post-secondary education ($\chi^2 = 41.70$; 6 DF; p<0.0005). Occupational classification and years of post-secondary education were unrelated to illness absenteeism in males.

Length of service with Esso showed a weak, but non-significant relationship with reported days sick. However, monthly salary, regardless of years of service or gender, was significantly related to illness absence. Regardless of gender, a linear relationship between monthly salary and the proportion of employees who reported zero days absent was evident, particularly when monthly salary exceeded $2,500 ($\chi^2 = 239.85$; 12 DF; p<0.0005). The proportion of employees who reported 1 to 3 days, and 4 to 15 days absent declined at a similar rate as monthly salary increased (Figure 5.2). Monthly salary was not associated with absences in excess of 16 days.

In summary, the preceding bivariate relationships suggest that employees at Esso displayed low annual absence when compared to other Canadian businesses and industries, who reported an average of 7 days per year (Shepardson, 1993).

Generally, the factors associated with absence among employees at Esso were similar to previous studies. Males were absent less than females. Age and absence showed an inverse relationship, with the exception of older females who were absent for 16 days or more. Marital breakdown was associated with increased absence, the number of dependents was also a factor in sick leave usage. Being in the management and professional ranks and having more education was associated with decreased absence in females, and increased salary showed a significant inverse relationship with absence in both males and females.

Figure 5.2 **Annual Days Absent Due to Illness Among Esso Employees by Monthly Earnings**



5.5.3 Participation and Illness Absenteeism

In order to determine the effect of participation in the fitness and lifestyle program on illness absenteeism, factorial analysis of covariance (ANCOVA) was performed with the mean annual days absent due to illness as the dependent variable adjusted for age, gender, occupational classification, marital status, number of dependents, education and income. All covariable measures were made at the time of employment at Esso, or entry to the fitness and lifestyle program. In the first analysis, the interaction variable, level x length of participation was included but was not significant ($F = 1.39$; 9 DF; $p = 0.1883$). Table 5.2 provides the results of the ANCOVA for all employees.

The overall model suggested a significant relationship between mean illness absence and the covariables ($F = 8.22$; 20 DF; $p=0.0001$). Type III sums of squares were used to make inferences regarding the covariables that were associated with illness absenteeism. Age, gender, salary and length of participation in the fitness and lifestyle program were all significant.

Repeating the ANCOVA with the DROP group excluded, or combined with the (NON+NOMEM) group and combined with the REG group made no difference to the significance of the covariables. In all repeated analyses, age, gender, salary and length of participation in the fitness and lifestyle program remained the significant predictors of annual illness absenteeism among Esso employees. Table 5.3 contains the solution vector for the significant variables.

In the case of the effects of length of participation, dummy variables were created and the effects of being in the fitness and lifestyle program for 1 year was set to zero. Therefore, the effects of the other four lengths of membership are estimates of the difference between each length of membership greater than one year and membership for one year. It was reasoned that the effect of length of membership within the first year was an appropriate "control" for the effects beyond that time.

Table 5.2 Results of the Analysis of Covariance

Source	DF	Sum of Squares	Mean Square	*F* Value	Prob. > *F*
Model	20	443.964	22.198	8.22	0.0001
Error	1152	3109.478	2.699		
Corrected Total	1172	3553.442			
	R-Square	**C.V.**	**Root MSE**	**Log (mean absence)**	
	0.125	- 341. 036	1.643	- 0.482	

Source	DF	Type III SS	Mean Square	*F* Value	Prob. > *F*
Age	1	37.278	37.278	13.81	0.0002
Gender	1	62.604	62.604	23.19	0.0001
Occupation	1	0.111	0.111	0.04	0.8393
Marital Status	3	12.059	4.019	1.49	0.2158
Dependents	4	12.990	3.247	1.20	0.3077
Education	2	4.347	2.174	0.81	0.4472
Salary	1	67.159	67.159	24.88	0.0001
Level of Participation	3	7.989	2.663	0.99	0.3983
Length of Participation	4	39.377	9.844	3.65	0.0058

As Table 5.3 indicates being a member of the fitness and lifestyle program for 3 and 5 years, respectively, differed significantly in the effect on illness absence.

Age and length of participation enter positively into the regression, suggesting that annual illness increases as age and length of membership in the fitness and lifestyle program increases. Conversely, being male and monthly earnings enter negatively, implying that males report fewer days absent than females, and that higher wage earners have lower annual illness absence rates than low income earners.

Table 5.3 Solution Vector for Illness Absenteeism

Parameter		Estimate	Std. Error of Estimate	t for H0: Estimate = 0	Significance of t
Age		0.01535	0.00560	2.7397	$p<0.05$
Gender (M)		- 0.23396	0.07894	- 2.9636	$p<0.05$
Salary		- 0.00014	0.00003	- 4.2947	$p<0.05$
Length:	2 yr	0.07684	0.11374	0.6756	n.s.
	3 yr	0.33889	0.14217	2.3837	$p<0.05$
	4 yr	0.22423	0.17225	1.3017	n.s.
	5 yr	0.27390	0.12203	2.2445	$p<0.05$
	1 yr	0.00000	.	.	.
Constant		0.10472	0.18397	0.5692	n.s.

Reference to the post-test annual absence data for each length of membership helps to clarify the relationships further. As Table 5.1 indicates, the effect of three years membership was associated with higher post-test mean absence in males and lower post-test mean absence in females than in year one. In program members of 5 years, females displayed higher mean annual absence than in the first year, while males were lower.

Level of participation was not a significant factor related to absence from illness, nor was there any interaction between level and length of participation. The remaining significant covariables support previous work in this area. Reduced mean annual absence from illness was significantly associated with being male, being younger and earning a higher salary (Leigh, 1986; Paringer, 1983). The results of the

ANCOVA differed somewhat from the bivariate comparisons. While gender, age and salary showed consistent findings, marital status, number of dependents, occupational classification and education failed to emerge as significant variables in the ANCOVA. This finding suggests the variance associated with these covariables was explained by age, gender and salary. Conversely, it may reflect a methodological problem with the ANCOVA model.

The variable illness absence was highly skewed and truncated, and while the log transformation provided a reasonable approximation of the normal plot, some skewness may have remained. Furthermore, the values would still have been truncated, at the value, log (0 + 0.1). Some regression coefficients may have failed to reach significance because the method of ordinary least squares (OLS) underestimated the true parameter value (Judge, et al., 1990). In order to test this hypothesis, the same variables were entered into a Tobit regression (Tobin, 1958), which provides more dependable predictions of absence than do least-squares estimates (see Study 3 for discussion).

5.5.4 Participation and Illness Absence in the Tobit Model

Table 5.4 details the results of the Tobit regression analysis with mean annual absence as the dependent variable, and age, gender, occupational classification, marital status, number of dependents, education, monthly income and fitness and lifestyle program participation (level and length) entered as predictor variables. In the interests of brevity, only those variables that achieved significance are included.

As the results show, the Tobit regression identified the same significant predictor variables as the ANCOVA procedure, with the addition of the "separated" category of marital status. This supports the previous bivariate comparison results where both males and females in the separated category demonstrated significant differences in illness absence to their colleagues. The Tobit regression estimates, however, are greater than the ANCOVA (OLS) estimates. This is explained by the tendency for OLS to underestimate, which is repeatedly observed in the literature on absence (Judge, et al., 1990).

Table 5.4 Results of the Tobit Regression

Explanatory Variable		Regression Coefficient (β)	Standard Error of Coefficient	Asymptotic Normal t Stat. (H0: $\beta = 0$)	Probability ($p > \lvert t \rvert$)
GENDER (Male)		- 2.5332	0.8529	- 2.9699	0.0030
AGE		0.1665	0.0604	2.7582	0.0058
MARST	(Separated)	10.9770	2.6882	4.0835	0.0001
SALARY		- 0.0015	0.0003	- 4.2551	0.0001
LENGTH	(2 yr)	4.0035	1.4815	2.7022	0.0069
	(5 yr)	3.2502	1.2733	2.5525	0.0107

5.6 DISCUSSION

The results of the ANCOVA and Tobit regressions suggest that illness absence was unrelated to participation in the fitness and lifestyle program at Esso. Using mean annual absence as the dependent variable, no significant differences were seen between any of the participant groups, even when the DROP group was omitted and recombined with (NON+NOMEM) and REG, or between employees who were, and were not members of the fitness and lifestyle program. The current study, therefore, finds no support for the hypothesis that participation in a workplace fitness and lifestyle program is associated with significantly reduced absence among participants as compared to non-participants.

While length of participation for 3 and 5 years, respectively was a significant covariable, it is concluded that length of employment at Esso, rather then length of program participation is, in fact, the significant explanatory variable. This conclusion is based upon the lack of significant difference in the dependent variable between members and non-members, when length of membership or employment is compared. In summary, the results of Study 2 suggest that illness absence can be explained by length of employment and personal variables alone, and that the degree to which one is active in the workplace fitness centre is of little consequence.

This results of this study contradict much of the previous research looking at the effects of worksite fitness programs on health-related outcomes, including absenteeism (Shephard, 1992). In the face of this finding, a review of the current methodology may shed light on the differences and allow reconciliation of these with previous results.

In an effort to preserve as much information for the analysis, illness absence was defined as the average of all annual days absent due to illness following the initial year of participation in the fitness and lifestyle program, or employment with Esso. This summary statistic was used for three reasons. Firstly, absence data were only available for the period 1986 to 1990, excluding approximately half of the cases available from the fitness and lifestyle program, which included 1981 to 1985 as well. Secondly, the high number of cases that entered the organization and/or program at different times throughout the five years, and the varying length of employment and/or membership that was maintained resulted in a high degree of left and right censoring of the data. Meaningful answers using ANCOVA with repeated measures would have been impossible because of the high percentage of missing data which necessitates casewise deletion. Finally, fitness and lifestyle program members displayed a high degree of variability in their level of participation from year to year, changing between non-active, occasionally active and regularly active status. The average over the years following the pre-test score seemed, therefore, to be a reasonable, conservative, and generalizable post-test score to use for analysis purposes.

Further, reductions in the sample size occurred as missing data in any of the included covariables resulted in casewise deletion. The lack of significance may well be explained by the reduced sample size and the small effect sizes, resulting in a lack of statistical power to detect the effects. However, much of the previous research which has investigated the effects of fitness and lifestyle program participation on rates of absence has failed to control for the same number of covariables included in this study. The findings of this study suggest that illness absence is explained by personal variables and tenure with the organization. Further research is recommended to determine the personal attributes of individuals who join, participate and remain members of workplace fitness and lifestyle programs, and how these profiles are associated with rates of absenteeism.

Finally, previous absence research has generally not reported such low annual absence rates, regardless of program participation. Typically, absenteeism rates range between 4 to 10 work days per year, and in manufacturing industries may reach rates as high as 30 to 40 days per year (Baun, 1995). At Esso, illness absence averaged only 2.6 days per year for all company employees. The ability to reduce this further may, therefore, have been limited, regardless of the organizational strategy. And, previous studies have not generally confined the absence measure to absences from personal illness alone. A lack of standardization of definition and measurement presents a challenge for the interpretation of absenteeism (Baun, 1995). It may well be that fitness and lifestyle programs are effective at reducing absences for reasons other than personal illness. In that regard, reductions would not be expected in the current study. Further study is recommended to clarify these relationships.

6. STUDY 3: FITNESS, LIFESTYLE AND HEALTH CORRELATES OF ABSENCE FROM WORK DUE TO ILLNESS

6.1 INTRODUCTION

Numerous studies in the psychological literature have examined individual and organizational predictors of absenteeism in the workplace. Extensive reviews by Muchinsky (1977), and Steers & Rhodes (1978), cover much of the earlier literature in this area, and more recent studies include those by Breaugh (1981), Cheloha & Farr (1980), Clegg (1983), Hammer & Landau (1981), and Jenkins (1985).

A review of this literature indicates that most studies have focused their attention on identifying work-related influences of absenteeism. References to the effects of work tenure and position, work pace, promotion, supervisor relations, earnings, and sick leave availability are frequent. The single question that appears to have received more attention than any other relates to the effects of job satisfaction on absenteeism. Muchinsky (1977), concluded that "highly consistent" results between job satisfaction and lower absenteeism had been found in prior research. Since 1977, however, the consensus has been questioned, as evidenced by Keller's (1983), comment that "more recent research has been almost as consistent in finding that job satisfaction was unrelated to absenteeism...".

Due to the limitations of the data used in this study, not all of the relations suggested in the psychological literature were examined. Nevertheless, the influences of age, gender, occupational classification and earnings were assessed.

A measure of job satisfaction was not included in the collection of the current data set. However, a self-rating of perceived job stress was, and was included in the analyses. The use of perceived job stress as a proxy for job satisfaction may be more appropriate in this study where the objective was to determine correlates of illness absenteeism. Previous research does not distinguish job satisfaction as a predictor specific to illness absenteeism, rather absences for any and all reasons. It is known, however, that high levels of perceived stress result in higher incidence of illness and disease, and may therefore better reflect the association of the job situation with illness absenteeism.

In the occupational medicine literature, studies of absenteeism have been concerned with environmental health hazards and, in particular, with smoking as a predictor of absence (e.g. Athansou, 1975; Bass, 1980; Holcomb & Meigs, 1972; Janzon, et al., 1981; Parkes, 1983).

Absence due to illness, *per se*, has not received the attention by medical researchers and economists that it has by psychological and management investigators. Much of the work by economists has been directed toward the effect of wages.

The prevailing opinion is that jobs with the greatest flexibility which allow many absences are most desirable. Employees are willing to forego higher wages for greater flexibility over their time at work. An inverse relationship, therefore, between wages and absenteeism is often predicted. However, the data do not appear to reflect any consistent pattern, and the relationship remains unclear.

Other relationships, on the other hand, appear to be more robust. Allen (1979, 1980), Leigh (1983), and Paringer (1983), all report a consistent positive relationship between absenteeism and employees who report themselves to be in poor health. Union members experience more absences than non-union members (Allen, 1981; Leigh, 1983). Apparently, union members feel greater job security and have less to fear from possible employer reprisals because of high absenteeism. Or conversely, non union employees may feel a greater commitment to the organization for whom they work. Allen (1980), and Paringer (1983), have demonstrated a correlation between increased absence and the availability of sick leave. This correlation spurs caution in relying on employee's statements regarding their true reasons for absence. Women with small children experience more absence than men and other women without small children. Current social norms regarding which parent typically cares for small children is generally cited as an explanation for this finding.

In this study, the relationships between health-related measures and illness absenteeism were assessed. These included: smoking and nutrition habits, alcohol and caffeine consumption, self-rated health status, use of medications and back problems. Further, the influence of the presence of young children in the family was included.

An extensive literature exists on the socioeconomic correlates of mortality, morbidity and longevity. The purpose of this brief review is to focus on those findings that are relevant to the question at hand, namely health-related correlates that are likely to influence rates of illness absence from work. Comstock & Tonascia (1977), and Grossman (1975), found strong evidence that formal education enhances health. Marriage also apparently confers some health benefit (Taubman & Rosen, 1982; Verbrugge, 1980). The effects, therefore, of formal education and marital status on absence due to illness were also evaluated in the current study.

In the fitness literature, absenteeism has been investigated primarily from the standpoint of its relationship to workplace fitness and lifestyle program participation and cost benefit and/or cost effectiveness (e.g. Blair, et al., 1986; Horowitz, 1987; White, 1987; Bell & Blanke, 1989; Lynch, 1990; Steinhardt, 1991; Shephard, 1992).

Existing literature regarding the link between physical activity, fitness factors and employee illness absenteeism has relied largely on bivariate, rather than multivariate techniques. Consequently, Spenser & Steers (1980), have commented that, "little is known about the *relative* influence of major antecedents on... absenteeism." In this study the influence of several physiologic measures of physical fitness on illness absence were analyzed. These included estimates of body composition, muscular endurance, flexibility and cardiovascular endurance. Additionally, measures of resting diastolic blood pressure and heart rate were included. Finally, length and level of participation in the workplace fitness and lifestyle program were also included.

To the knowledge of this author, multiple factors of physical activity, fitness, lifestyle behaviours, health status, job situation and personal characteristics in relation to illness absenteeism have not yet been assessed. This study represented an attempt to do just that.

6.2 PURPOSE OF STUDY 3

The purpose of study 3 was to predict rates of illness absenteeism from fitness and lifestyle program participation, lifestyle behaviours, health status, job situation and personal characteristics among members of the employee fitness and lifestyle program at Esso Resources for the period 1986 to 1990.

6.3 STUDY DESIGN

Beginning in 1981, Esso Resources Canada, implemented an employee fitness and lifestyle program at the Canadian Resources Headquarters in Calgary. Since then, systematic records have been kept on members' fitness, lifestyle behaviours and health status by means of an annual assessment. This data was combined with job situation and personal characteristics information from the Human Resources department to develop a list of variables which were used to predict illness absenteeism in fitness and lifestyle program members.

Table 6.1 presents the variables and definitions. Most are self-explanatory, but a few deserve further explanation. The variable NUTR is a composite score, reflective of five nutritional habits. The score ranges from 5 (poor) to 25 (best) and reflects the respondent's normal behaviour with respect to: eating the recommended number of servings of food each day (Canada's Food Guide, 1986); eating regular meals each day; the use of salt; and, the consumption of foods high in polyunsaturated fats and sugar. The rationale being, that a combination of these nutritional habits impacts on health more so than any one habit in isolation.

Previous research on absenteeism indicates that women are more likely to be absent than men. These findings suggest that the major reason for the disparity pertains to the care of small children. For this reason, an interaction variable FDEP was constructed, which was the product of being female and the number of dependent children under 6 years of age in the family.

6.4 MEASURING ABSENTEEISM

In conducting the present study, two concerns arose; the first relates to the dependent variable. In measuring absenteeism, the variable itself presented some unique methodological concerns. The two most often used measures of absenteeism are frequency and total time-lost. Frequency generally refers to a count of absence spells in a certain period, while total time-lost refers to the amount of time for all spells combined. Hammer & Landau (1981), argue that frequency measures are more stable and less susceptible to skewness and leptokurtosis than are time-lost measures, and are therefore more appropriate in multiple regression analyses which

Table 6.1 Variable Definitions and Summary Statistics

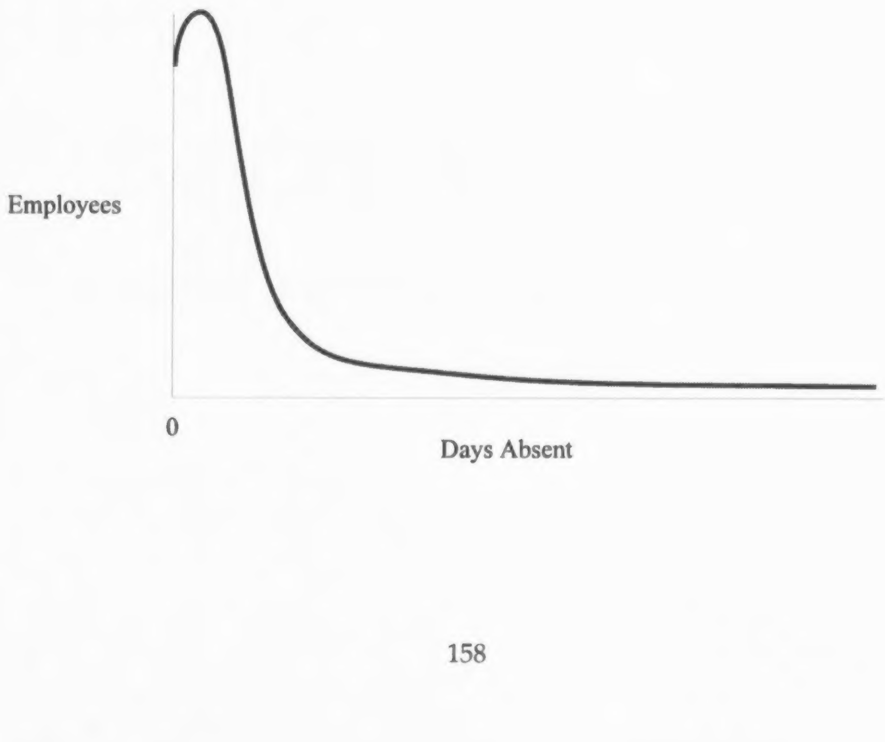
Variable	Description	Mean (SD)
GENDER	Gender (Female = 1, Male = 2)	
AGE	Age (years)	30.99 (8.46)
BMI	Body mass index (ht/wt^2)	23.83 (3.22)
SOS	Sum of five skinfolds (mm)	66.51 (26.50)
WHR	Waist to hip ratio	0.82 (0.83)
SRFLEX	Forward hip flexion (cm)	29.71 (10.58)
SITUP	Number of sit-ups performed in one minute	22.75 (13.83)
VO2	Predicted maximal oxygen uptake (ml/kg/min)	41.19 (7.45)
RDBP	Resting diastolic blood pressure (mmHg)	77.81 (8.32)
RHR	Resting heart rate (bpm)	68.06 (10.37)
PAWORK	Occupational physical activity (1:sedentary; 2:light; 3:active; 4:very active)	1.82
JASTRS	Job-related stress (1:always; 2:frequently; 3:occasionally; 4:seldom; 5:never)	2.75
PRESFI	Self-rated fitness level (1:poor; 2:fair; 3:good; 4:excellent)	2.44
PHYSAC	Leisure time physical activity (1:never; 2:occasionally; 3:monthly; 4:1 to 2/week; 5:3 to 4/week; 6:5 to 7/week)	4.10
NUTRI	Adherence to Canada's Food Guide (range: 5 to 25)	17.05 (2.68)
NOSMOK	Number of cigarettes/cigars/pipes smoked each day	1.29 (5.19)
NODRIN	Number of drinks of beer/wine/liquor consumed each week	3.30 (4.44))
NOCAEF	Number of cups of coffee/tea consumed each day	2.47 (2.13)
HEALTH	Present state of health (1:poor; 2:fair; 3:good; 4:excellent)	3.11
BACK	Back problems (1:yes; 2:no)	
MEDIC	Medications taken on a regular basis (1:yes; 2:no)	
LENGTH	Length of continuous membership in the Fitness Centre (years)	1.89 (1.39)
PARTIC	Level of participation in Fitness Centre (1:non; 2:occ; 3:reg; 4:drop)	2.67
OCC	Occupational Classification (1:management; 2:administrative)	
SALARY	Gross monthly salary	3590.90 (1688.40)
EDGROU	Years of post-secondary education completed (1:<4yr; 2:4yr; 3:>4yr)	1.74
MARST	Marital status (1:separated; 2:divorced; 3:single; 4:married)	
DEPS	Number of dependents under 6 years of age	0.36 (0.71)
FDEP	Female * DEPS	0.59 (0.24)
ABSENT	Mean annual days absent due to personal illness	2.60 (7.86)

require a normally distributed dependent variable for the purposes of hypothesis testing. However, frequency measures are not as likely to reflect absences due to illness as are time-lost measures. An employee may suffer a severe illness and be absent from work for a period of 20 days. The frequency measure would count this as only one absence while the time-lost measure would record it as 20. If it is desired to measure not only the incidence of poor health, but also achieve some understanding of the severity, then time-lost methods are superior (Smulders, 1980).

6.4.1 Tobit Analysis

As previously discussed, the time-lost measure suffers some statistical drawbacks as a dependent variable if multiple regression is used. Firstly, the data are truncated at zero (no employee will report negative days of absence and many will report exactly zero). Secondly, the time-lost measure are positively skewed (a long tail to the right) and leptokurtic (Figure 6.1).

Figure 6.1 The Distribution of Absence from Work



Hammer & Landau (1981), suggest the Tobit maximum likelihood estimation technique to handle these difficulties. The Tobit (Tobin, 1958), is designed for such dependent variables and is a substantially more efficient estimator than ordinary least squares (OLS) for the same truncated, skewed and leptokurtic distribution (Leigh, 1985). This is particularly true if the degree of truncation is between 25% and 50%, according to Paarsch (1984).

The Tobit estimator does not suffer from heteroskedasity which would affect the OLS estimator. As such, for dependent variables such as time-lost methods, the Tobit estimator provides more consistent, reliable and less biased estimates than OLS (Leigh, 1985; Maddala, 1983). Judge, et al. (1990), have presented an example data set to illustrate the use of the Tobit maximum likelihood estimation and compare the results with the OLS method using the same data set.

Twenty observations were drawn from a population where 6 of the observations were "limit" observations (zero), 14 were "non-limit" (greater than zero) and it is known that:

$$\beta_1 = -9, \quad \beta_2 = 1 \quad \text{and} \quad \delta^2 = 16$$

The estimates for these three parameters are indicated in Table 6.2 below. Column 1 of the table contains the OLS parameter estimates based on all 20 observations. Column 2 contains the estimates based only on 14 "non-limit" observations. Note that the estimates for the OLS methods are less than the true parameter values. The maximum likelihood estimates of the Tobit regression model are reported in column 3. These estimates are closer to the true values.

Table 6.2 Parameter Estimates for OLS and Tobit ML

Estimate	1 OLS:20 obs.	2 OLS:14 obs.	3 Tobit
$\beta_1 = -9$	-2.15	-1.49	-5.73
$\beta_2 = 1$	0.69	0.65	0.90
$\delta^2 = 16$	9.89	11.36	13.18

The Tobit model is designed to handle dependent variables that assume some value with high probability (zero in this case) and are continuously distributed beyond this point with the remaining probabilities. As in other loglinear models, maximum likelihood techniques are used to estimate the regression weights which are derived through an iterative process as opposed to a formula. The resulting equation represents the truncated distribution with a standard normal density function (Hammer & Landau, 1982). Because of its construction, the Tobit estimator cannot make predictions below the truncated (zero) value; the OLS estimator does not have this property.

In short, the primary benefit of the Tobit model for absence prediction accrues from the lack of bias in its estimates, and the attendant improvements in the confidence of the predictions (Baba, 1990). This is a matter of some interest to the designers of corporate fitness and lifestyle programs, where one of the organizational objectives may be to reduce rates of illness-related absenteeism. The improvements in the confidence of interpretation provided by the Tobit model may lead to better developed programs which include absence reduction as an objective.

6.4.2 Multicollinearity

The second concern relates to the problem of multicollinearity. Because all potential correlates included in Table 6.1 will be considered in the analysis, the potential for two or more to be correlated with each other exists. In past research, income appears to be positively correlated with age and education, and negatively with being female. In the present study, these correlations involving income would, therefore be expected. Multicollinearity makes it more difficult for any one variable to pass a significance test. According to Leigh (1986), the alternative, which requires dropping, or combining variables, is not necessarily advisable. As variables are dropped from the estimation equation, omitted variable bias can affect all remaining estimated coefficients so that the desirable property of unbiased estimators associated with the Tobit procedure is destroyed. By including all variables in the equation and acknowledging the possibility of multicollinearity, the confidence in the variables found to be significant is enhanced. That is, the variables found to be significant when multicollinearity exists are likely to be more significant if multicollinearity could be removed (Leigh, 1986).

Many have suggested stepwise regression in which variables are added sequentially and their effects on the increase in R^2 (assumed to be the unique variance explained by the new variable) is assessed. However, if any multicollinearity is present, and it is suggested by Beals (1972), that no data set can completely escape all multicollinearity, there is no such thing as unique variance explained by any one predictor variable. Only if all predictor variables are perfectly orthogonal (i.e. they have zero sample covariance with each other), can R^2 be allocated among predictor variables. Zero sample covariance is difficult to achieve in any data set (Beals, 1972; Gujarati, 1975).

6.5 MEASURES

The demographic, fitness, lifestyle and health-related measures used in this study have been described previously (Chapter 3). For the purpose of this analysis, a predictive model was developed using data from all five years in one analysis. In this way, short-lived fluctuations that may have affected illness absences were minimized. For example, if data were used from any one shorter time period where, perhaps a cold or flu epidemic were to have occurred, resulting absence estimates may have been severely biased. Or, if cold and flu epidemics are a seasonal occurrence, then including the data from all five years at once will have the result of averaging the effect on absence rates, which may have been more or less severe in any one year.

Illness absence was measured as the mean total days absent due to illness per year. This value was gathered from official company records, and computed from the total days absent during an employee's tenure, divided by the number of years of tenure.

Strictly speaking, the nature of the absence data renders this study "postdictive" as opposed to predictive. However, given that previous absence is the strongest predictor of present or future absence (Breaugh, 1981), and given the extended length of the absence period sampled, it is suggested that the findings can be viewed in a predictive sense.

6.6 DATA ANALYSIS

In this study, the Tobit regression estimates were calculated using SHAZAM version 7.0 (White, 1993) software. In this model absenteeism data was classified into two groups. One portion of the data was equal to the "limit" zero and the second portion was above the limit. An index I was created which is a linear function of the predictor variables, and can be written as:

$$I_t = X_t' \alpha = X_t' \ (\beta/\delta)$$

The parameters of the Tobit model are the vector α and a normalizing parameter δ where α is a vector of *normalized* coefficients corresponding to the predictor variables. The index I is then transformed to a predicted limited dependent variable. The coefficient vector α is transformed into the regression coefficient vector β by multiplying the elements of α by the calculated standard error of the estimate δ. In the SHAZAM output the coefficient listed for the dependent variable mean absenteeism is actually equal to (1/δ) while the output labelled "STANDARD ERROR OF THE ESTIMATE" is the estimate of δ and "VARIANCE OF THE ESTIMATE" is the estimate of δ^2.

Interpretation of the Tobit model is complicated by the fact that all computations are performed on the *normalized* α vector, and the estimated standard errors of the coefficients are those of the α vector and not the β. However, SHAZAM permits hypotheses testing on the regression coefficients β ($H0{:}\beta = 0$) by using the TEST command. This is accomplished by using elements of the normalized model. The estimate of the y coefficient in the normalized model is $1/\delta$ (definition of the normalized model is: $y/\delta = \beta/\delta + e/\delta$), and the test therefore, is $\beta/y = 0$.

In this study the data was regressed using the Tobit model. Regression coefficients (β), standard error estimates (δ) and asymptotic normal t-statistics were computed for each predictor variable, to determine the ability of fitness, lifestyle and health-related measures to predict illness absenteeism in employed fitness and lifestyle program members.

As in Study 1 and Study 2, the premise that the DROP group may have biased the results in some fashion was considered. Tobit regressions were repeated three times: i) omitting the DROP group; ii) combining the DROP and NON groups; and, iii) combining the DROP and REG groups.

In this study many predictor variables (parameters) were included in the analysis. Therefore, the maximum likelihood function was represented by a surface rather than a curve, as in the case of one parameter. The analysis seeks to find the parameter values which maximize the surface, and give the best estimate of illness absenteeism. To test the significance of each parameter's contribution to estimating illness absenteeism, the asymptotic normal t-statistic and associated probability value was calculated.

Finally, several of the parameters were represented by categorical predictor variables, which necessitated an additional procedure in order to estimate the degree to which each category predicted illness absenteeism. For example, using an independent variable such as marital status (MS) coded as:

1	single
2	separated
3	divorced
4	married

The variable should not be entered directly into the regression, as this assumes that the effect on illness absenteeism of being married is four times greater than the effect of being single. In fact, it may well be that the effects of the categories are quite unrelated. Therefore, a procedure to enter each category to the regression individually was required. This was accomplished by creating a series of indicator (dummy) variables (one less than the number of categories) to describe the effect of each of the marital states independently. In this case, three indicator variables MS_1, MS_2, MS_3 were constructed as follows:

MS	MS_1	MS_2	MS_3
1	0	0	0
2	1	0	0
3	0	1	0
4	0	0	1

The regression equation was then in the form:

$$y = \beta_1 MS_1 + \beta_2 MS_2 + \beta_3 MS3 + e$$

Such that, if a person was in state 2 the only term that appeared in the regression was MS_1 since $MS_2 = MS_3 = 0$. Therefore, ${}_1\beta$ could be interpreted as the effect of state 2, i.e. separated, and so on.

6.7 RESULTS

The purpose of study 3 was to predict rates of illness absenteeism from fitness and lifestyle program participation, lifestyle behaviours, health status, job situation and personal characteristics in members of the employee fitness and lifestyle program at Esso Resources for the period 1986 to 1990. Illness absence was measured as the mean total days absent due to illness per year. This value was gathered from official company records, and computed from the total days absent during an employee's tenure, divided by the number of years of work tenure.

Variables were regressed using the Tobit model (Tobin, 1958) and estimates were calculated for each predictor using SHAZAM version 7.0 (White, 1993) software. Regression coefficients (β), standard error estimates (δ) and asymptotic normal t-statistics were computed for each predictor variable, to determine the ability of fitness, lifestyle and health-related measures to predict illness absenteeism in employed fitness and lifestyle program members.

6.7.1 Study 3 Population

Absenteeism data were available for a total of 1,597 employees who worked at Esso Resources Headquarters between 1986 and 1990. However, due to missing data in variables to be included in the analysis, complete data were available for a total of 1,131 employees (436 female and 695 male), who were members of the fitness and lifestyle program (496 DROP, 364 REG, 185 OCC and 86 NON). The employees included in this study represent approximately 71% of the employees who were members of the fitness and lifestyle program between 1986 and 1990, and approximately 37% of all employees who joined the program between 1981 and 1990. The risk of bias due to the reduced sample size is acknowledged, but it is assumed that employees with missing data are random among this population and therefore do not affect the outcome of these analyses.

As in Study 1 and Study 2, the premise that the DROP group may bias the results in some fashion was considered. Tobit regressions were repeated three times: I) omitting the DROP group; ii) combining the DROP and NON groups; and, iii) combining the DROP and REG groups.

6.7.2 Results of the Tobit Regressions

Table 6.1 presents the parameters from the Tobit regressions explaining mean annual days absent due to illness among members of the Esso fitness and lifestyle program between 1986 and 1990. In the interests of brevity, only those variables that achieved statistical significance are presented. A one-tailed test was used when an explanatory variable was hypothesized to have either a positive or negative and not zero effect. A two-tailed test was used for exploratory hypotheses. The decision to use a one-tailed vs. a two-tailed test depended upon prior expectations for the variable. For example, it is generally believed that health problems contribute to absence. Thus, the health-related variables should be judged against the critical value for a one-tailed test ($t = 1.645$; $p<0.05$). However, a variable such as age should be judged against the critical value for a two-tailed test ($t = 1.96$; $p<0.05$) because their are conflicting hypotheses about how age affects illness absence. On the one hand, age is associated with increased susceptibility to illness and injury, while on the other older workers appear to be more committed to their jobs and have an increased work ethic, and are less likely to be absent for minor illnesses such as colds.

Four sets of numbers appear in the table. The estimated regression coefficients of the explanatory variables (β) and the standard error of the coefficient appear in columns 1 and 2, respectively. Column 3 lists the asymptotic normal t-statistic, which is a test of the null hypothesis that there does not exist a non-linear relationship between the given explanatory variable and the dependent variable, mean annual illness absence. Finally, column 4 contains the probability values that the explanatory variable is reliably predictive of mean annual illness absence.

Within Table 6.1, there are several footnotes that refer to effects of omitting or recombining the DROP group. The DROP group only had an effect on the model when they were omitted totally from the regression. Combining the DROP group with the NON and REG groups in separate regressions failed to alter the significant predictors found in the model when all fitness and lifestyle members were included.

Footnote 1 indicates significance at the $p<0.05$ level in a one-tailed test with all fitness and lifestyle members included in the model. In this case, length of participation in the fitness and lifestyle program for 2 and 4 years, respectively, entered positively, while sit and reach flexibility entered the model negatively.

Table 6.3 Results of the Tobit Maximum Likelihood Regression Explaining Mean Annual Days Absent Due to Illness

Explanatory Variable	Regression Coefficient (β)	Standard Error of Coefficient	Asymptotic Normal t Stat. (H0: $\beta = 0$)	Probability ($p > \|t\|$)
GENDER (Male)	- 2.5228	0.8527	- 2.9584	0.0031
FEM*DEP	3.1996	1.6878	1.8957	0.0580 [2]
MARST (Separated)	6.9081	2.7112	2.5479	0.0108
SALARY (Monthly)	- 0.0015	0.0003	- 4.2988	0.0000
EDUC (> 4 yr)	- 2.5235	0.9035	- 2.7929	0.0052 [2]
FLEX	- 0.7109	0.3776	- 1.8828	0.0597 [1,3]
PHYSAC (Occasion.)	- 4.9538	2.1651	- 2.2881	0.0221 [3]
(Monthly)	- 5.9262	2.3294	- 2.5440	0.0109 [3]
(1 - 2/ wk)	- 7.2775	2.2742	- 3.2000	0.0014 [3]
(3 - 4 /wk)	- 6..1054	2.3539	- 2.5937	0.0095 [3]
(5 - 7 /wk)	- 5.1049	2.5156	- 2..0293	0.0424 [3]
SMOKE (30-60/day)	10.7820	5.9596	1.8093	0.0704 [2]
PRESFIT (Excellent)	- 4.5474	2.1196	- 2.1454	0.0319 [3]
MEDIC (None)	- 1.7885	0.9468	- 1.889	0.0589 [2]
LENGTH (2 yr)	2.1608	1.2330	1.7524	0.0797 [1,2]
(3 yr)	4.8897	1.5258	3.2047	0.0013
(4 yr)	3.2083	1.8270	1.7560	0.0791 [1,2]
(5-10 yr)	3.7088	1.3169	2.8162	0.0049
Model 1: (All Employees)				
CONSTANT TERM = 11.8860		$\delta^2 = 108.82$	Log l = - 2723.1884	p<0.01
Model 2: (DROP group omitted)				
CONSTANT TERM = 8.1482		$\delta^2 = 80.701$	Log l = -1632.3883	p<0.01

[1] Indicates significance at the p<0.05 level in a one-tailed test

[2] Indicates significance at the p<0.05 level in a one-tailed test with DROP group omitted

[3] Indicates variable failed to achieve significance with DROP group omitted

All other variables achieved significance at the $p<0.05$ level in a two-tailed test. Footnote 2 indicates significance in a one-tailed test when DROP group employees were omitted from the model. Finally, footnote 3 indicates the variables that achieved significant in the model with all employees, but failed to achieve significance when DROP group was omitted.

6.7.3 Overall Fit of the Tobit Regressions

Two regressions were calculated, based upon the impact of including or omitting the DROP group from the model. In model 1, which included all members of the fitness and lifestyle program (DROP group included), the regression included a constant term, 11.8860. The overall fit of the Tobit regression for model 1 can be assessed by considering the statistic -2 (Log-likelihood ratio) which is distributed as a chi-square (Tobin, 1958). The value of the Log-likelihood ratio for model 1 is, - 2723.1884, resulting in the test statistic = 5446.4; which is well over the critical chi-square value of 50.9 (30 DF; $p<0.01$).

In model 2 where the DROP group was omitted from the analysis, the value of the Log-likelihood ratio is, -1632.3883, and hence, the test statistic = 3264.8; again, well over the critical value for chi-square at 30 DF; $p<0.01$. The likelihood ratio test of the Tobit is equivalent to the F-test for multiple regression, and the meanings are analogous. When the calculated ratio exceeds the critical value, as it does here, the null hypothesis, that all of the coefficients on every explanatory variable are zero, is rejected.

McDonald and Moffitt (1980), have noted the common error in the literature of assuming that the Tobit regression coefficients measure the correct regression coefficients for observations above the limit value of zero. They have presented a formula to estimate partial derivatives that allow a greater understanding of the relationship between the independent and dependent variables. The Tobit regression coefficients (β) are used to calculate estimated partial derivatives using the formula in McDonald & Moffitt (1980): $F(x) \cdot \beta$, where $F(x)$ is the cumulative normal distribution evaluated at the mean values for the vector of explanatory variables, x; and, β is the Tobit regression coefficient. $F(x)$ is included as part of the Tobit printout, and the calculations are, therefore simple to complete. Table 6.2 lists the significant Tobit regression coefficients and estimated partial derivatives evaluated at the mean.

The estimated partial derivatives then indicate how a one-unit change in an independent variable is associated with a change in the dependent variable holding all other variables constant. For example, the estimated coefficient of - 0.3 on flexibility means that a one-unit (cm) increase in sit and reach flexibility is associated with 0.3 unit (day/year) reduction in absenteeism, holding all other variables constant. Partial derivatives are useful in assessing the importance of an independent variable in any regression model (Leigh, 1988), and permit a greater understanding of the practical significance of the explanatory variable.

6.7.4 Personal Characteristics and Illness Absence

Gender (male) entered negatively in both models, suggesting that males were less likely than females to be absent due to illness. This finding is in agreement with the aggregate statistics presented in Study 2. Dependents under 6 years of age were not a predictor of absence. However, being female and having dependent children under 6 years of age was significant in both models, and associated with increased illness absence. Being separated from a spouse entered positively as a predictor of illness absence in both models.

Education entered negatively, indicating that those employees with more than four years of post-secondary education were less likely to be absent. Occupational classification did not emerge as a significant predictor, but monthly salary did. Those who earn higher monthly salary were less likely to be absent from work. Age entered positively, but failed to achieve significance in either model.

6.7.5 Fitness and Illness Absence

All fitness variables failed to achieve significance. The exception, sit and reach flexibility, entered as a positive predictor in the overall model. When the regression was confined to members of the fitness and lifestyle program only, none of the fitness variables achieved significance. This finding, therefore, questions the hypothesis that improved fitness is associated with reductions in illness absenteeism. However, as reported in Study 1, fitness levels of participants were generally heavily clustered around the "average" category, with little variance to explain differences in absence.

Table 6.4 Tobit Maximum Likelihood Regression Coefficients and Estimated Partial Derivatives[4] Explaining Mean Annual Days Absent Due to Illness

Explanatory Variable		Regression Coefficient (β)	Estimated Partial Derivatives at the Mean	Probability $(p > \|t\|)$
GENDER	(Male)	- 2.5228	- 1.1153	0.0031
FEM*DEP		3.1996	1.4145	0.0580 [2]
MARST	(Separated)	6.9081	3.0541	0.0108
SALARY	(Monthly)	- 0.0015	- 0.0007	0.0000
EDUC	(> 4 yr)	- 2.5235	- 1.1156	0.0052 [2]
FLEX		- 0.7109	- 0.3143	0.0597 [1,3]
PHYSAC	(Occasionally)	- 4.9538	- 2.1901	0.0221 [3]
	(Monthly)	- 5.9262	- 2.6199	0.0109 [3]
	(1 - 2/ week)	- 7.2775	- 3.2174	0.0014 [3]
	(3 - 4 / week)	- 6.1054	- 2.6992	0.0095 [3]
	(5 - 7 / week)	- 5.1049	- 2.2569	0.0424 [3]
SMOKE	(30-60 / day)	10.7820	4.7667	0.0704 [2]
PRESFIT	(Excellent)	- 4.5474	- 2.0104	0.0319 [3]
MEDIC	(None)	- 1.7885	- 0.7907	0.0589 [2]
LENGTH	(2 yr)	2.1608	0.9553	0.0797 [1,2]
	(3 yr)	4.8897	2.1617	0.0013
	(4 yr)	3.2083	1.4184	0.0791 [1,2]
	(5-10 yr)	3.7088	1.6397	0.0049

[1] Indicates significance at the $p<0.05$ level in a one-tailed test

[2] Indicates significance at the $p<0.05$ level in a one-tailed test with DROP group omitted

[3] Indicates variable failed to achieve significance with DROP group omitted

[4] Estimated partial derivatives are calculated using the formula of McDonald & Moffitt (1980): $F(x)\ .\ \beta$, where $F(x) = 0.4421$, the cumulative normal distribution evaluated at the mean for the vector of explanatory variables, x, and β is the Tobit regression coefficient.

6.7.6 Lifestyle Behaviours and Illness Absence

The DROP group had a impact on whether lifestyle behaviours achieved significance in predicting illness absence. In the regression which included the DROP group, all categories of leisure time physical activity entered negatively, suggesting an inverse relationship between illness absence and activity during leisure hours. Smoking, however, did not achieve significance. When the regression was run omitting the DROP group, leisure time physical activity failed to achieve significance at any level, and smoking more than 30 cigarettes/cigars/pipes per day achieved significance in a one-tailed test at the $p<0.05$ level. Alcohol and caffeine consumption, and nutritional habits were not predictors of absence among fitness and lifestyle program members at Esso.

6.7.7 Self-Assessed Health Status and Illness Absence

Self-rated physical fitness of "excellent" entered negatively in the overall model, suggesting that employees who judge their own physical fitness to be excellent display lower illness absence than their colleagues. This is an interesting finding given the lack of significance of all but one of the objective measures of fitness.

In both models, the use of over-the-counter or prescription medications on a regular basis was a significant predictor of illness absence. Neither self-rated health status, work-related stress and physical activity, nor, surprisingly, chronic back problems were predictors of illness absence.

6.7.8 Fitness and Lifestyle Program Participation and Illness Absence

Level of participation in the fitness and lifestyle program was not a significant predictor of illness absence, *per se*. Nor was the of interaction of level and length of participation. The DROP group, however, had an impact on the overall predictive model depending on whether they were included in the regression or not (see Table 6.3). Length of membership in the program was, however, a predictor of absence. All categories of membership length entered positively, suggesting that fitness and lifestyle program membership of more than one year is predictive of increased illness absence. This finding is in agreement with the results of Study 2. However, the population in Study 2 also included employees who were not members of the fitness and lifestyle program, suggesting that an increase in illness absence may be associated with length of employment at Esso and not purely length of membership in the fitness and lifestyle program. This argument would be consistent with earlier findings of Pocock (1973), who found mean annual absence higher in employees with ten or more years service in comparison with those with less than ten years. However, conflicting results have been found relating to length of service and absenteeism (Muchinsky, 1977).

In summary, when all employees were included in the regression model, illness absence at Esso was positively correlated with being separated from a spouse, being female with dependent children under 6 years of age and being a member of the fitness and lifestyle program for longer than one year. Illness absence was negatively correlated with being male, "excellent" self-rated physical fitness, leisure time physical activity, the avoidance of taking prescription or over-the-counter medications on a regular basis, years of post-secondary education, and sit and reach flexibility.

When employees who dropped out of the fitness and lifestyle program were omitted from the regression, leisure time physical activity failed to predict illness absence, but smoking in excess of 30 cigarettes/cigars/pipes per day was positively correlated.

6.8 DISCUSSION

The results of Study 3 suggest two explanatory models for illness absence among participants in the fitness and lifestyle program at Esso Resources Headquarters for the period 1986 to 1990. The distinguishing characteristic between the two models is whether a group of employees who dropped out of the program within their first year of membership were included or omitted from the analyses. Fitness and lifestyle program participation, *per se*, from less than once a month up to five times per week, was not a significant predictor of the use of sick time among this group.

The omission of program dropouts from the regression analysis had the effect of removing leisure-time physical activity and flexibility as predictors of reduced absence, and introduced smoking in excess of 30 per day as a positive predictor. While it is unclear as to the reason that certain employees dropped out of the program within the first year, these results may offer an explanation, as well as an interpretation of the influence of this group on the predictive model.

It is suggested that employees who dropped out did so to pursue physical activity outside of the fitness and lifestyle program - on leisure hours. It was therefore in that regard, that they responded to the question regarding leisure time physical activity giving their self-rated frequency. Those that remained in the program may have indicated that they completed little or no leisure time physical activity because they were in fact active in the workplace program and did little else beyond that. Whether this group regarded activity completed at the workplace fitness centre as leisure time activity is less clear. Results from Study 1 (Chapter 4), however, suggest that the allowance at Esso for fitness centre use during work hours is reflected in this result. Program participants, particularly regularly active members , in fact reported little or no leisure time physical activity for two reasons. Firstly, they were active in the workplace fitness centre and secondly, they regarded the workplace activity as non-leisure time activity, because of the allowance to engage in it during work hours.

The employees who participated in the fitness and lifestyle program reported little or no leisure time physical activity and, therefore had little departure from the "zero" situation in the regression analysis. This was particularly true for the regularly active group. Leisure time physical activity was assessed as an explanatory variable by computing the effects of the categories of activity as estimates of the difference between each category and zero leisure time activity. Therefore, when dropouts were excluded from the analysis, there was insufficient variance around leisure time physical activity as a predictor of illness absence. Conversely, when the dropouts were included the variance associated with leisure time physical activity enters negatively as an explanatory variable on illness absence.

When dropouts were omitted, smoking more than 30 cigarettes/cigars/pipes per day became a positive predictor of illness absence. In Study 1, smoking demonstrated an inverse relationship with level of program participation. However, among members of the dropout group there was no consistent pattern in smoking behaviour. As a consequence, their inclusion in the analysis had a moderating effect on smoking as an explanatory variable for illness absence.

Sit and reach flexibility entered as a negative predictor for illness absence when the dropouts were included in the analysis. Inspection of the data demonstrated similar scores in flexibility between the dropouts and regularly active participants. In this case the inclusion of dropouts lent strength to the association between flexibility and illness absence. When the dropouts were omitted, the non-active group had a moderating effect on flexibility as an explanatory variable.

6.8.1 Personal Characteristics Variables

Personal characteristics variables such gender, age, education, marital status, number of dependents, occupation, salary and length of service have received attention from previous researchers from a variety of fields of interest (see Muchinsky, 1977; Steers & Rhodes, 1990 for reviews). It is reassuring that for some of these variables, similar results were achieved. Psychologists, economists and epidemiologists have noted a consistent gender difference in rates of absence (Steers & Rhodes, 1990), though Leigh (1986), pointed out that being female and having dependent children under the age of six was a stronger predictor of absence than gender alone.

The results from the present study regarding the effect of gender and being female with dependent children are encouraging in that they are consistent with earlier findings in Leigh (1986), and Pines, et al. (1985). Both the statistical significance (GENDER: p=0.0031; FEM*DEP: p=0.0580) and the size at the estimated partial derivatives (GENDER: - 1.1153; FEM*DEP: 1.4145) indicate a strong effect on the dependent variable. Mothers with small children are more likely to report absences than men or than women without small children. The results have a clear policy implication. If firms like Esso wish to reduce absence among their female employees with small children, they should consider sponsoring day care centres, or supporting legislation to provide day care, or subsidies for day care. As day care becomes more available, and social norms regarding which of the parents provides the majority of child care change, then the interaction variable may cease to be as important in predicting absence.

One further comment regarding females with small children is warranted. The dependent variable was confined to company classified illness absence. It is curious, therefore, that the interaction variable was a significant predictor of personal illness absence. In this regard, it is possible that mothers of young children experience greater illness as a consequence of "sharing" illness and minor infections with their children. Or, that reporting an absence due to a child's illness as a personal illness was a practice, despite the fact that Esso's policies allowed absence for a dependent child's illness.

Marital breakdown (being separated) achieved statistical significance (p=0.0108), and was a strong predictor of illness absence (partial derivative = 3.0541), suggesting that being separated was associated with three times higher sick time use than being single. The results are in agreement with Leigh (1986), who found that separated employees experienced 20-27 more hours of annual absence than single or married employees. However, contrary to previous research, in the present study divorced and married employees were no different than single employees in rates of absence due to illness. Leigh (1986), reported that being divorced was similar to being separated in predicting absence. What is unclear in the present study is the recency of divorce. Leigh (1986), observed that divorce within the previous 12 months was a strong predictor of absence. It is possible that the individuals in the current study were divorced for longer periods of time, and while officially they were divorced, for all intents and purposes, they were in fact single people.

The statistically significant results for education are consistent with previous findings (Grossman, 1975; Pincus, 1987), who reported education as one of the strongest predictors of health and longevity. Individuals with greater years of schooling tend to report themselves to be in better health than individuals with fewer years of schooling. It may also be that individuals with more education obtain safer jobs where they experience less injury and illness. The results are also consistent with Mowday and Spenser's (1981), "high scope" and "low scope" job distinction since more educated employees at Esso were found in "high scope" or management/professional /technical jobs. This strong health-education-job association may also explain the lack of significance of occupational classification as a unique explanatory variable among this group of employees. In either event, post-secondary education of less than four years was associated with an increase in absence of approximately one more day per year than employees with four or more years of post-secondary education.

Research by economists have suggested that wages play a role in explaining absenteeism (Winkler, 1980; Allen, 1981). Employees who are paid high wages are less inclined to report illness absence than those who are paid low wages. Leigh (1991), has explained this as the "opportunity cost" for being absent when sick leave is not available. Table 6.4 reflects this wage hypothesis, demonstrating a reduction in annual absence of 0.7 days per year per $1,000 increase in monthly salary. It is unknown, however, what the sick leave availability among individual employees was, other than the fact that sick leave was earned at a rate of 15 days per year for all employees at Esso.

6.8.2 Fitness Variables

With the exception of sit and reach flexibility, fitness measures were statistically insignificant as predictors of illness absenteeism. Fitness is strongly associated with health and longevity (Bouchard, et al., 1994; Paffenbarger, 1994). However, few, if any previous studies of fitness-health-absence associations enter as many covariates as entered in this study. The lack of association between fitness and illness absenteeism, therefore, may have resulted from correlations between fitness and other variables. However, the lack of significance for fitness should not be surprising, given the very small improvements in objective measures among employees as a consequence of participation in the fitness and lifestyle program, and the tendency for most employees to cluster around the "average" category of fitness, regardless of level of participation.

Sit and reach flexibility achieved significance in model 1 at the level of a one-tailed test ($p<0.05$) and was associated with a reduction of 0.3 days per year for each centimeter increase in flexibility score. The fact that flexibility was the only fitness variable to achieve predictive significance may result from the effect size associated with the pre-test, post-test difference (see Study 1: Table 4.5). Of the fitness variables, it was the only one to achieve a medium effect (e.s.: females = 0.21; e.s.: males = 0.18), as measured by the criterion of Cohen (1985); the remainder were all small or very small.

Alternatively, flexibility may be associated with other variables like back problems. According to annual Worker's Compensation Board reports (1990 - 1994), next to the common cold, back ailments are the most frequent cause of absenteeism from work. Employee fitness and lifestyle programs which address the need for increased low-back flexibility have the potential of impacting lost work time due to back ailments. An association between flexibility and a reduction in the incidence of back problems might also explain the lack of predictive significance of the back problem variable in this study.

Previous research (Parkes, 1987), determined the effects of excessive weight on absenteeism. She found a "U-shape" relationship between relative weight and absenteeism. Both underweight and overweight people reported more absences than those of average weight for their height. This study considered three indices of body composition, all of which displayed very small effects, and no predictive association with absence. Repeating the analysis and dichotomizing the study population into those of average weight for height, and those that were obese (see Chapter 4 for description) still resulted in an insignificant relationship between body composition and absence. The inconsistency with Parkes' previous work requires further investigation.

The lack of association between cardiovascular fitness and absence likely results from the very small effect size associated with involvement in the fitness and lifestyle program at Esso. However, previous research is equivocal. Linden (1969), Bowne, et al., (1984); Steinhardt, et al. (1991) showed a significant negative relationship between cardiovascular fitness and absenteeism in customs officers, office workers and police officers. To the contrary though, Linden (1969); Boyce, et al. (1991); Cox & Montgomery (1991) found cardiovascular fitness measures to be poor predictors of absenteeism in firemen, office workers and hospital workers. The results of this, and previous studies suggest a need for further clarification of the relationship between cardiovascular fitness and illness absence.

6.8.3 Lifestyle Behaviours Variables

While the list of lifestyle behaviours does not include all possible, it does nevertheless reflect those that are cited in the health literature as having the most significant relationships to health status (Wankel & Sefton, 1994). The variable that has received the most attention in prior studies appears to have been smoking. According to the National Centre for Health Statistics (1990), employees who smoke report approximately 50% more sick leave, and have a 50% higher chance of being hospitalized than non-smokers. Further, it is estimated that smokers in the US spend 150 million more days in bed and 81,000 more days off the job. The American Council of Life Insurance has reported that smokers cost companies almost $300 more than non-smokers in health insurance claims, and approximately $500 per year in costs for damage and replacement of furniture and equipment.

In this study smoking included the number of cigarettes, cigars and pipes smoked per day, which also gave an indication of the non-smoking population (0 smoked per day). Unfortunately, the quality of the smoking variable did not allow the identification and inclusion of the those that had recently quit. That is, those that had recently quit were included in the non-smoking (0 per day) category which may have been inappropriate when considering absence due to illness and reduced health. The poor quality of the variable, therefore may explain the lack of association in model 1, and why it is confined to smoking in excess of 30 per day in model 2. Nevertheless, smoking more than 30 per day was associated with a large increase in reported annual sick days used, accounting for 4.7 days per year more absence than the non-smoking group ($p<0.05$).

With respect to other lifestyle behaviours that impact upon health and illness absence, adherence to Canada's Food Guide, caffeine and alcohol consumption showed no significant relationship to the dependent variable. The findings are consistent with previous work, which determined that alcohol use was not a predictor of absence (Cook, 1990), but in contrast to Jenkins (1985), who found poor appetite to be a significant predictor of absence. However, Jenkins' work was conducted on a population of nurses in London, England, where nutritional habits are likely not the same as those among employees at Esso in Calgary, Canada.

Leisure time physical activity was a significant predictor of absence in model 1 (reasons for its lack of significance in model 2 have been previously discussed). Even occasional leisure time physical activity was significantly associated with a reduced rate of annual illness absence of approximately 2 days (p=0.022). Engaging in leisure time physical activity once or twice a week was associated with the greatest reduction in illness absence of approximately 3 days, while other categories were associated with between two and three days reduced absence (Table 6.3). This is an encouraging finding, and lends support to the hypothesis that physical activity, even below levels that result in objective changes in measures of physical fitness, has a positive effect on the reduction of absences resulting from personal illness.

As described by Bouchard & Shephard (1994), leisure time physical activity is one that is undertaken during an individual's discretionary time and that leads to a significant increase in caloric expenditure. Personal needs or choice dictate the type of activity and the motivation may be for fitness or health improvement, but may also be for numerous other reasons. The significant negative association found in this study supports previous epidemiological research demonstrating a link between leisure time activity and improved health (Morris, et al., 1980; Chave, et al., 1978; Paffenbarger, et al., 1978, 1986; Froelicher, 1988; Kannel, et al., 1986; Siscovick, 1982; Leon, 1987), as assessed by reduction in overall coronary heart disease risk. It would follow as well, that because people generally do not call in sick as a result of coronary heart disease, that in this employee population, leisure time physical activity was more probably associated with reduced illness absence as a result of more generalized health benefits.

6.8.4 Health Status Variables

In previous studies by economists (Leigh, 1986; Paringer, 1983) and epidemiologists (Taylor, 1976), overall measures of employees' health appeared to be the most important covariate of absenteeism. This suggests that a large, perhaps the major, amount of absence results from genuine illness or injury and not malingering or personal business. Steers and Rhodes (1990), have stated that questions involving health and the employees' ability to attend work are a deserving area of study. The importance of health is underscored in a recent study by Leigh (1991). He found that a group of health variables explained more variation in absenteeism than any other set of covariates. Similarly, Paringer (1983), found health variables to be more strongly associated with absenteeism than economic variables.

The results of the current study are unable to corroborate these findings. Of the group of health status measures included in this study, only the avoidance of the use of medications was consistently significant in both models. Self-rated "excellent" physical fitness was negatively associated in model 1 and accounted for a reduction of 2 days per year in sick leave usage (p=0.0319). Upon inspection of the data, this significant association was accounted for by males, a greater proportion of whom had lower absence and higher self-ratings of fitness than females.

The avoidance, or lack of need, to take prescription medications on a regular basis was associated with significantly reduced absence of approximately 2 days per year (p=0.0319). This result is hardly surprising. One might have anticipated this relationship, particularly in the western world where medications are generally sought as the immediate and initial solution to illness and minor ailments.

A possible explanation for the lack of consistency between this study and the work of Leigh (1991), and Paringer (1983), is the way in which health related covariables are defined. In the current study health variables included, self-ratings of current health status, physical fitness, work stress, work-related physical activity, back problems and the use of medications. The variables related to smoking, drinking alcohol and caffeine, nutrition and leisure time activity were grouped in a "lifestyle behaviours" set. Leigh (1991), for example, included these behaviours in his health variables along with others related to the recency of a cold or flu, and work-related safety issues.

6.8.5 Fitness and Lifestyle Program Participation Variables

Level of participation in the fitness and lifestyle program was not significantly associated with mean annual illness absenteeism. Length of membership, on the other hand, was positively associated with sick leave use, accounting for between 1 and 2 days increased illness absence in employees with memberships of greater than one year (Table 6.3). However, as discussed in Study 2, the lack of any differences between fitness and lifestyle program members and non-members in rates of annual illness absence, suggests that length of employment at Esso, and not necessarily length of membership in the program is the explanation (see Chapter 5 for detailed discussion on fitness and lifestyle program participation and illness absence).

6.8.6 CONCLUSIONS

The following eight conclusions can be drawn from Study 3:

1. The group of employees who dropped out within their first year of membership had a significant influence on the overall model predicting illness absence among fitness and lifestyle program members. The major influence was on the significance of leisure time physical activity as a predictor of sick time usage. With dropouts included in the model, leisure time physical activity entered as a significant predictor. It is concluded that dropouts left the fitness and lifestyle program to engage in physical activity on their discretionary time. As a significant predictor, leisure time physical activity accounts for a reduction of 2 days per year illness absence among Esso employees.

2. Smoking in excess of 30 cigarettes, cigars and/or pipes per day was associated with the largest increase in annual days absent at approximately 5 more than non-smoking colleagues.

3. As a group of covariates, personal characteristics accounted for the greatest variance in illness absenteeism, with marital breakdown resulting in separation from a spouse as the most important predictor among them.

4. Physical fitness variables, with the exception of flexibility, failed to achieve significance in predicting illness absence. This arises from the extremely small effect sizes associated with each measure of fitness following participation in the fitness and lifestyle program.

5. Fitness and lifestyle program participation failed to predict illness absence. It is concluded that this is due, in part, to the lack of differences in annual absence rates between program members and non-members. As well annual absence rates were very low among all employees at Esso between 1986 and 1990, and the degree of change over time was also very small.

6. The positive association observed between length of program participation and illness absence is the result of an association between length of service at Esso and absence, and not program participation, *per se*. This conclusion arise from the lack of any difference between program members and non-members in annual rates of sick leave usage.

7. The Tobit regression analysis technique provides an accurate solution for determining the multivariate relationships between illness absence and explanatory variables. As with all empirical results, however, the degree to which they may be generalized to other employee groups depends in large part to the similarities or differences between the employees, the organization in which they work, including the environment or corporate culture.

8. Study 3 provides support, in part, for the modification of the Bouchard, et al. (1991) model as proposed in Studies 1 and 2, linking physical activity, fitness, health and illness absenteeism. Chapter 7 illustrates the modified model and indicates the relationships between explanatory variables and illness absence as determined in this study. The modified model is used as the basis for presentation of overall conclusions from the three studies, as well as discussion and recommendations for future workplace health promotion programming and investigation.

7. SUMMARY OF INVESTIGATION AND RECOMMENDATIONS

7.1 INTRODUCTION

The overall purpose of this investigation was to evaluate the effects of participation in the Esso Plaza Fitness & Lifestyle Program on fitness, lifestyle, health and illness absenteeism for the period 1981 to 1990. The model proposed by Bouchard, et al. (1991), which provides a description of the relationships among habitual physical activity, health-related fitness, and health status, was a useful framework on which to hypothesize the particular relationships among program participation, fitness, lifestyle, health and illness absenteeism. Based upon previous absenteeism research and current hypotheses, a modification to the model was proposed to include illness absenteeism (Figure 1.2). Lines linking illness absenteeism to the other components of the model were constructed. Arrow heads indicate the direction of influence and were based upon previous research (where available) or current exploratory hypotheses.

A series of three related studies were conducted which attempted to elucidate the strength of the relationships among the components in the model. Strictly speaking, design limitations of these studies do not permit inferences regarding the direction of these relationships. However, arguments for what is more plausible, not merely possible, will be presented in this Chapter.

7.2 OVERALL CONCLUSIONS

1. The results from Study 1 support previous research into the relationships among physical activity, fitness and health and lend support to the model proposed by Bouchard, et al. (1991). In this study, participation in the Esso Plaza Fitness & Lifestyle Program was associated with improvements in measures of fitness, lifestyle and health, regardless of gender or level of participation. However, while the results achieved statistical significance, the effects were general very small, and the members of the program were reflective of the "average" for age- and sex-matched Canadians. The one exception was in the proportion of employees who reduced their health risk due to obesity, which was in stark contrast to secular trends towards increased fatness. In summary, the results of Study 1 were consistent with previous research.

2. Contrary to previous research, Study 2 found no support for the hypothesis that those employees who are members of workplace fitness programs are absent from work less than their colleagues. In Study 2, fitness and lifestyle program participation was not associated with reduced illness absence. However, involvement in leisure time physical activity was associated with reduced illness absence.

3. Previous research in the fitness and lifestyle literature has not employed the Tobit maximum likelihood estimator (Tobin, 1958) as the analysis tool for the investigation of illness absence, despite the methodological advantages over ordinary least squares. Nor have previous investigations considered as many determinants of absence concurrently in an attempt to determine the effects of fitness and lifestyle program participation.

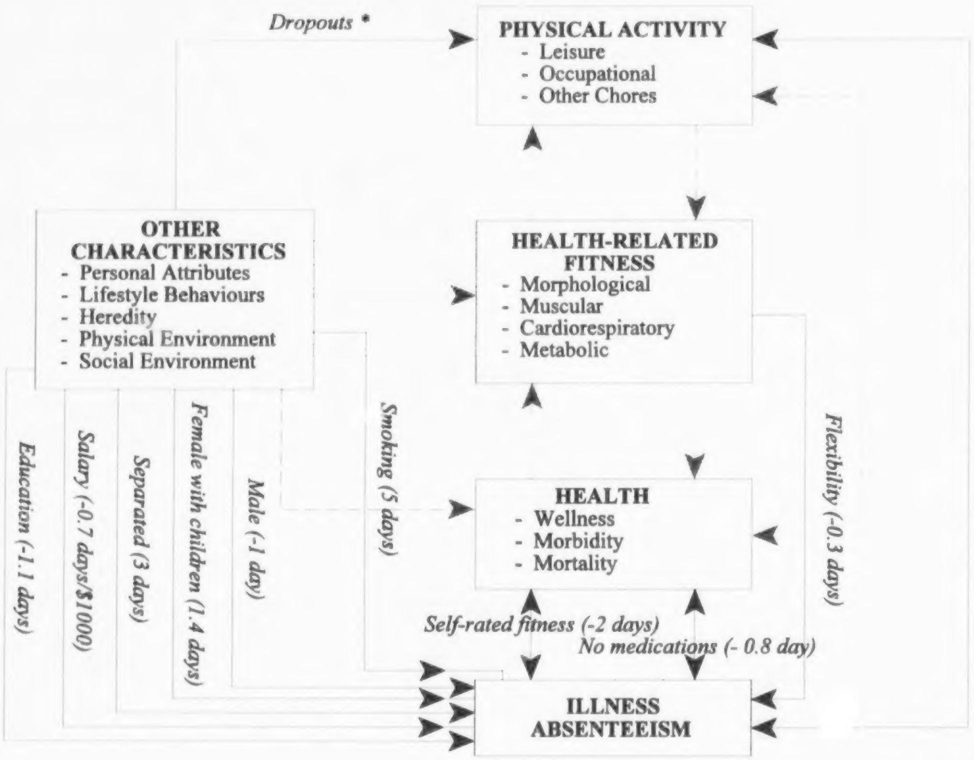
Study 3 found no relationship between program participation and illness absence. However, as shown in Figure 7.1, the Tobit regression analyses provided a greater understanding of the determinants of illness absence among members of fitness and lifestyle programs than previously reported. The results have clear implications for the sponsors and researchers of workplace health and fitness programs.

7.3 THE RELATIONSHIPS AMONG PHYSICAL ACTIVITY, FITNESS, HEALTH AND ILLNESS ABSENTEEISM

Figure 7.1 specifies the strength of the relationships among program participation (physical activity), fitness, health, personal characteristics and illness absenteeism, in terms of the associated annual days absent due to illness for each predictor variable. Arrow heads are included to provide greater understanding of the most plausible explanation of each relationship.

Clearly, the model suggests that the strongest component affecting illness absence is personal characteristics, which included six significant measures in this investigation. Leisure time physical activity, hip and low back flexibility, self-rated fitness and the use of medications were also significant determinants.

Figure 7.1 **The Relationships among Habitual Physical Activity, Fitness, Lifestyle, Health and Illness Absenteeism**



* Employees who dropped out are included to indicate a personal attribute that resulted in increased leisure time physical activity.

——— Solid lines indicate significant relationships between the indicated covariate and illness absence

— — — Dashed lines indicate relationships in Bouchard, et. al. (1991) original model.

7.4 A CONCEPTUAL APPROACH TO WORKPLACE HEALTH PROMOTION

The results of this investigation do not support previous research indicating participation in workplace fitness and lifestyle programs as a means of reducing illness absenteeism. However, organizations can, and should still implement workplace health initiatives that include the promotion of physical activity, but with a different approach to traditional programs which have focused on improvements in physical fitness and reductions in physical health risk factors.

The approach, it is suggested, must be developed systematically and constructively and needs to take a comprehensive view of improving employee health and well-being through the promotion of healthy lifestyles that include physical activity as one of a broad array of healthful pursuits. Further, the approach should acknowledge a broad spectrum of factors that influence employee health beyond just personal fitness and lifestyle choices. Organizations should also consider the environmental and organizational factors that can be modified so as to promote and enhance workers' health, well-being and attendance at work.

This approach is consistent to that described by the Canadian Centre for Active Living in the Workplace (Cunningham, 1993), which is attracting a growing interest by organizations who are introducing new employee health and lifestyle initiatives, or by those who are looking to revitalize existing fitness-based programs. The elements of this approach combine to form a systematic framework on which organizations can develop, implement and evaluate employee health promotion initiatives.

7.4.1 Commitment and Support

A positive statement of commitment and support is needed from all stakeholders within the organization. Commitment means responding to health and lifestyle needs in a cooperative fashion as well as making available sufficient resources in the long term. Key to developing commitment and support is regular and open communication toward a shared vision by senior management, supervisors, unions and employees. All stakeholders must be involved in creating the vision, developing supportive policies and procedures, and promoting the concept among their constituents. Sufficient resources to support and ensure the vision must also be forthcoming. Consideration of the following principles can facilitate commitment and support throughout an organization:

I) Organizational Climate and Timing.

The current degree of understanding and acceptance of health and lifestyle promotion at the organization is important to understand. Whether the concept is novel, or whether it is something that has been developing gradually in different departments is a factor in the ultimate success of the initiative. The organization should seek to understand whether this approach to employee health and well-being is something that workers are interested in, or whether it will be perceived as an intrusion, or just another thing to be added to their work.

ii) Workplace Champions

Champions create excitement and enthusiasm for health promotion efforts in the workplace. They should be credible figures, especially with their constituent stakeholder groups. They need to be enthusiastic and knowledgeable about the general concepts of health promotion as well as the specific organizational initiatives to be implemented in order that they generate energy and enthusiasm among others.

iii) Educate Employees

Workshops, seminars, reference materials, and promotional campaigns can all further the awareness and understanding of the principles of health promotion. An added benefit of workshops and seminars is that they provide opportunities for interaction and support, and generate enthusiasm for new ideas.

iv) Workplace Networks

Information exchanges and visits to and from other organizations can broaden understanding of the kinds of health promotion initiatives that are possible. Understand and utilize available expertise and resources such as local community services and groups, and most importantly, look to the employee population for needs, preferences and cultural norms.

v) Working Groups

Working groups with representatives from employees and employers can work together to develop strategies for gaining commitment and support from their constituents. These groups can be encouraged to engage actively in the planning and implementation of health promotion efforts. Above all, keeping everyone informed is crucial to obtaining commitment and support. Successful communication channels developed at this stage will prove invaluable later in the process.

All of these activities are intended to obtain commitment and support by creating and building knowledge, understanding and awareness of health promotion among all stakeholders within the organization.

7.4.2 Assessing the Current Situation

The process of implementing health promotion initiatives requires decisions about what actions to take and how to deploy resources to achieve the greatest impact. Ensuring the successful development of health promotion initiatives requires an understanding of the current employee health situation. Collecting information on the current situation through existing data sources and further inquiry provides insight into health promotion needs, available resources, and potential solutions. For example: information relating to current health-related costs; illness and injury rates; employee health needs, interests and expectations; risk factors; and, present organizational health policies and practices will assist in defining the current health situation.

I) Organizational Assessment

Organizational assessment includes an assessment of the way in which work is organized. This includes determining current policies and procedures, shift work requirements, work pace and repetition, roles and responsibilities, and systems for monitoring and ensuring accountability as they relate to employee health promotion. In assessing these things, organizations should be generally concerned with the degree to which, a) they are present, and b) how well they are supported and adhered to by all members of the organization.

ii) Environmental Assessment

Determining workplace norms, which are a reflection of people's values, attitudes and beliefs, is at the heart of the environmental assessment. This includes understanding the philosophy regarding employee health promotion, determining the degree and freedom of communications, and the extent to which workers are involved in creating healthy workplaces. Environmental assessment also considers the extent to which the physical surroundings impact upon employee health, and would include considerations within the rubric of ergonomics.

iii) Individual Assessment

Individual assessment focuses on the personal determinants that permit employees to complete their work tasks in a healthy manner. Education and training, ongoing development and recognition, and the provision of personal protective equipment and assistive devices are examples. In addition, programs and support services, such as employee assistance programs, lifestyle management and child care are also included as part of the individual assessment.

Developing appropriate initiatives to improve employee health and well-being is dependent upon an understanding of the current situation which then allows for specific initiatives to be developed through a strategic planning process.

7.4.3 Strategic Planning

Strategic planning is the thoughtful process of combining the information from the situational assessment into priorities and action plans. Priorities are formalized as goals and objectives that specify a direction of health promotion change, how the change will be measured, the target group, and a time frame. An action plan accompanies each objective and details the activities, tasks, timelines and responsibilities required to accomplish each objective.

It is a basic requirement of strategic planning that all stakeholders are represented in the process. This means that management, unions, employees, and other identified internal and external resources are crucial participants.

7.4.4 Health Promotion Intervention(s)

Interventions are the specific activities designed to effect the health and well-being changes identified as the strategic plan goals and objectives. Interventions should present a balance between the three areas that influence employee health - the individual , the organization, and the environment, and must acknowledge the demographics, preferences and cultural norms of the workforce.

Health promotion efforts that consider changes at the environmental and organizational levels will have a facilitating effect on individually focused initiatives. Typically, interventions have focused extensively on the individual and omitted necessary supportive changes to the workplace and the way work is organized. Fitness, nutrition, back care, smoking cessation and stress management programs are examples of individual type interventions. While these interventions are may be necessary to the success of the employee health promotion initiative, they cannot be done at the exclusion of developing organizational systems and an environmental climate that supports the effort.

7.4.5 Monitoring and Evaluation

The health promotion plan should include mechanisms to periodically monitor health and well-being initiatives. Monitoring is the informal process of obtaining input and feedback from planners, providers and participants by asking "How are we doing"? Evaluation is the more formal, long-term assessment of the ongoing situation, and of the efficiency and effectiveness of health promotion initiatives.

Evaluation requires the disciplined collection of health-related information at strategic points in time. This information is valuable to decision makers at different stages in the implementation process. During the initial stages of obtaining commitment and support and early in the program planning and development, current situation assessment data is required. As health and well-being initiatives are strategized and implemented, process evaluation data is important. Finally, the maintenance or revamping of initiatives will be more successful if they are based on outcome evaluation results. The ongoing renewal of the implementation process means that the monitoring and evaluation phases and data collection will often overlap.

7.4.6 Maintenance

A crucial step in the program implementation process is a series of actions designed to ensure health promotion continues to grow and create new challenges in the workplace. Maintenance efforts are designed to maintain commitment and sustain achievements, and may include the development of new initiatives, recharging old efforts, and relapse prevention. The ongoing renewal of the implementation process is key to all of these actions. Results obtained from the evaluation of health and well-being initiatives provide the impetus for renewing commitment, reassessing the current situation, adapting the strategic plan, expanding interventions, continually monitoring and evaluating progress, and maintaining achievements.

7.4.7 Summary

When Confucius was asked how a man might complete a journey of a thousand miles, he pondered and responded, "one step at a time." The essence of the proposed implementation process is a "one step at a time" approach to workplace health promotion. And, just as it is true that a man will never walk a thousand miles unless he begins with the first step, so it is true of the successful implementation of health promotion initiatives.

It has been the practice in many organizations to skip steps in the implementation of health promotion initiatives. Too often program coordinators enter the process at the intervention stage. Sometimes the initiative is successful. More often, however, it fails. Without having previously gained commitment and support, developed an understanding of the current situation, and arrived at good strategies through planning, the failure of the initiative is understandable.

Organizations that set out to promote and develop healthy workplaces must do so effectively and efficiently. The proposed implementation process provides a comprehensive, systematic and ongoing step-by-step approach to creating healthy workplaces and healthy employees.

7.5 RECOMMENDATIONS FOR WORKPLACE HEALTH PROMOTION PROGRAMS

The above implementation process notwithstanding, the results from this investigation suggest the following recommendations for those organizations considering the implementation of health promotion initiatives which include objectives related to the improvement of employee health, and the reduction of illness absenteeism:

1. Smoking

The leading cause of illness absence is respiratory disease which is more prevalent among smokers than non-smokers. The current investigation demonstrated that employees who smoke in excess of 30 per day accounted for 5 more days absence due to illness than non-smokers. It is recommended that workplace health promotion programmers implement policy to prohibit smoking in all areas of the organization premises, and make concerted efforts to assist employees who smoke to quit.

Smoking cessation programs have had limited impact on workers' smoking habits, and recidivism was high. This situation arises from the fact that most smoking cessation programs have typically been individually focused, and medically based. The most common method of encouraging employees to quit was to finance the cost of treatment. Few provided on-site cessation classes, and fewer addressed organizational and environmental factors that contributed to an employee's smoking habit.

Recently, however, more organizations have considered these factors and many more now have on-site cessation classes, acknowledging the positive effect of the peer support system. Many have introduced organizational policy, and created smoke-free workplaces. The proportion of organizations taking a strong position against smoking is still small, however. Given the high associated cost related to illness absence, changing the habit of employees who smoke should be a priority for workplace health promotion programmers. In this effort, they must consider all factors that contribute to an employee's habit, and make every attempt to create organizational systems and supports where non-smoking is the cultural norm.

2. Leisure Time Physical Activity

This investigation confirmed previous studies showing that workplace fitness and lifestyle programs typically attract about 20% of the workforce to participate. As well, the typical emphasis of these programs has been on fitness and improvements to physical health. Presumably this segment of the employee population is motivated by the promise of improved strength, flexibility and aerobic power. However, the remaining 80% of the workforce, which includes those that drop out of fitness programs, appear to require some other reason to include physical activity in their lives. In order to motivate these employees toward physical activity as a leisure time pursuit, each must be convinced of the benefit(s) of changing behaviours in that direction.

Figure 7.1 illustrates a saving of 2 to 3 days per year among employees who reported even moderate levels of leisure time physical activity. It is recommended, therefore, that organizations promote the inclusion of physical activity among their employees' leisure time pursuits. In this context, physical activity should be promoted as a healthful pursuit for benefits beyond typical fitness improvements. The promotion should emphasize the point that even moderate amounts of physical activity can positively influence health, and that the benefits can be wider than those accrued in fitness or physical health. For example, physical activity can provide benefits in emotional and social health if, for example, the activity is focused on spending time with family, friends or others. Or, physical activity can provide gains in spiritual and intellectual health if the focus, for example, is on spending time on a forest nature trail, or learning about the life on a sea shore.

3. Employee Assistance Programs

Employee assistance programs (EAP) have grown from their roots in assisting employees with alcohol and drug dependency problems, to comprehensive personal counseling programs that provide leadership and expertise in a variety of health-related areas. Key among these is EAP growth in stress management, critical incident debriefing and family counseling programs. As EAP continue to develop, dovetailing with health and lifestyle programs improves the efficiency and effectiveness of employee health promotion at the workplace.

It is recommended that workplaces introduce EAP as a component to their overall employee health promotion strategy. In this investigation, approximately 5.5 days per year were lost due to absence related to employees who had suffered marital breakdown (separated), were female with dependent children under six and who reported regular medication use. Further, those employees who smoked added an additional 5 days, as discussed above. Some of the issues associated with the reasons for these absence statistics may be better dealt with through EAP. Critical components of EAP include confidentiality and individual counseling. Issues that are private and difficult for employees to address may be better dealt with in one-on-one, confidential settings. The overriding need, however, for a comprehensive approach to employee health promotion means close communications are necessary between all components of the workplace program, including health promotion, EAP and medical, for example.

4. Females with Dependent Children Under Six

In this study, females with dependent children under six demonstrated almost one and a half days more absence than males. Either societal norms appear to suggest that females are still the partner that is responsible to tend for sick children, or mothers of small children are sick more often than fathers. The former conclusion being the more plausible, it is recommended that organizations consider workplace strategies that address the concerns of mothers with small children in an effort to curb associated absence.

Key among these initiatives is a recommendation for organizations to assist with child care. Among the options available to organizations are: child-care centres; information and referral services; child-care room; after-school program; summer program; sick child service; and, reducing employees' child care costs.

Child care centres, and information and referral services are particularly useful in reducing absenteeism where current child care arrangements are unreliable or non-existent. Where communities have few child care services available, organizations may benefit by providing on-site child care centres. It would seem that on-site centres offer at least two advantages that are attractive to employees, one which may be beneficial in reducing absence. First, transportation time and costs to the employee may be reduced if the parent and child travel to the same destination. Second, parents would prefer to be close to their child's care centre in the event they are required to attend to an accident or illness. On-site child care provides easy access, and may reduce absence to a minimum as a result.

In many cases, child care problems occur after school hours, or when school is closed due to bad weather, teacher conferences or vacations. In these cases, establishing a semi-permanent child care room on the organization's premises where child care is available on an as needed basis may prove beneficial in curbing absence. When school is closed during the summer months, child care services are often hard to secure. Providing a summer program, as was done by Fel-Pro Industries, is one possible solution (Friedman, 1980). Children accompanied their parents to work, and from there, a company bus transported the children to the campsite - a forest preserve owned by the company. The cost was $10.00 per week, which was subsidized by Fel-Pro. These types of programs, may also provide employment opportunities for older children as camp counselors or leaders. An alternative to company-operated program would be to contract with a local agency, such as the YMCA, to provide the program.

What to do when a child is sick is a dilemma for working parents. Most certified child care centres are prohibited from caring for a child who is sick. Moreover, home-based child care centres are reluctant, at best, to provide care for a sick child because of the fear of infecting other children. Finding emergency child care services is difficult, and hiring a private nurse is financially prohibitive for most parents. Hence, either the sick child stays at home unattended or one of the parents stays at home with the child. An employer-sponsored sick child care program could, if not eliminate employee absence due to sick children, at least reduce the amount of time off to a minimum.

At least two options are available to organizations for establishing such a program. First, an employer could support an on-site sick child care program, particularly where the organization is large and has existing medical services and resources. A second option is an employer-sponsored in-home care program for sick children. An example of the second option is provided by the Canadian Imperial Bank of Commerce (CIBC), in Kingston, Ontario (Knight, 1995). If a CIBC employee has a child who is sick, they can call the Victoria Order of Nurses and a health care aide will look after the child for the day. The employee goes to work and the bank covers the cost.

The program costs the bank $14.50 per hour, and is currently in the pilot program phase. Based upon cost-effectiveness studies, the program may continue as either employer-paid, employee-paid or a mix. The program, however, reflects an understanding on the part of the bank that the organization's health is dependent upon employees being available for work, and arises from a comprehensive approach to all of the issues surrounding child care needs at the CIBC.

In this chapter, the results of this investigation have been summarized, and recommendations made with regard to a framework for a systematic and constructive approach to workplace health promotion. Specific recommendations dealing with smoking cessation, the promotion of leisure-time physical activity, employee assistance programs and child care have been identified as significant initiatives to be considered in the bid to reduce absence from work. Although these programs would appear to impact some of the causal factors of absence, strictly speaking the design of this investigation limits the certainty to what is most plausible. Further, these initiatives may not be appropriate for all organizations; their appropriateness depends on the particular reasons for absence faced by the employees. It must be re-emphasized that the implementation of such programs should employ a systematic and strategic approach which ensures that all initiatives have organizational commitment and support, are based upon an understanding of the needs, and which employ clear methods for evaluation and rejuvenation. Finally, initiatives must take a comprehensive approach to health promotion. Individually focused behaviour change efforts must be supported by organizational and environmental change.

7.6 RECOMMENDATIONS FOR FURTHER RESEARCH

This investigation has elaborated on the relationships between workplace fitness and lifestyle program participation and changes in fitness, lifestyle, health and illness absenteeism. Figure 7.1 proposes plausible directional relationships between the various factors and points to the need for further investigation, particularly with regard to the determinants of absence from work due to illness.

1. Further Model Testing

This model needs to be tested in different types of work organizations in order to determine its generalizability to other workforces. Particularly helpful would be research designs and data sets that permit better longitudinal assessment than were possible in this study. Of particular concern in this model is the need for a clear differentiation between absence from work due to personal illness and absence for other reasons. Additional theoretical work will depend upon a clear definition and understanding of the dependent variable being studied.

2. Absence Cultures

Further research is required on the psychology of absence. Absence has different meanings to different people, and collectively these meanings define an absence culture. How absence cultures develop and how workplace health promotion programs may influence absence cultures are important questions for study. Research methodologies will require a focus on organizational units as a reflection of absence cultures, rather than individual analyses.

Directly related to this are the specific strategies that organizations employ to enhance employee's motivation and ability to attend work. A framework for program development, implementation and evaluation, as well as a number of specific recommendations were made arising out of this investigation. These strategies are proposed based on correlational rather that experimental support. The need for well-controlled experimental studies is therefore, acknowledged and recommended.

3. Leisure-time Physical Activity

Further research is required to elucidate the relationship between leisure-time physical activity and reduced illness absenteeism. Of key interest, are the types of activity pursued, and the perceived benefits of the activity. Determining the activities that people engage in on their leisure time and the reasons may provide useful clues to the most effective social marketing strategies to promote physical activity. To date, we have relied upon the appeal of improved fitness. However, we now know that only a small percentage of the population are motivated by these benefits. A qualitative approach in which the investigator asks subjects direct open-ended questions about the types of activity and motivations for their leisure-time pursuits would be an appropriate research strategy.

4. Participatory Research

The successful development, implementation and evaluation of workplace health promotion programs requires close cooperation and communication between researchers and programmers in an effort to seek solutions to health-related problems in the workplace. In the context of this investigation, and in many workplaces, the problem is to reduce illness absence. It is recommended that the most appropriate approach to further research is to utilize a participatory research process. By this, participatory research is defined as systematic inquiry, with the collaboration of those affected by the issue being studied, for the purposes of education and taking action or effecting social change (Green, et al., 1995).

In the case of workplace health promotion initiatives, this means a commitment to involvement in the research process by senior management, supervisors, unions, employees and researchers. In this manner, all stakeholders are involved in the various activities: the researchers are included in the program development and implementation process, and the workplace members become involved to varying degrees at each stage of the research process. Most participatory research processes begin with the premise that the members of the workforce have particular insights about the health-related problems and solutions to the problems. At the same time, researchers become active participants with a commitment to improving health-related conditions at the workplace.

In conclusion, as workplace health promotion programs are designed and implemented, in part to reduce absence, it is critical that rigorous evaluation of their effectiveness be undertaken. Of particular interest is an understanding of the types and motivations for involvement in physical activity, and how these programs can influence absence cultures through improved motivation and ability to attend work. These questions will require participatory research strategies which at times employ well-controlled experimental designs, qualitative methods and multi-site or multi-unit comparisons. Additionally, data sets that are collected in a systematic fashion over extended periods, which incorporate as many of the factors known to influence absence, and which clearly define absence are required. These requirements will be more successfully met if there is cooperation and close communication between researchers and workplace members in a process of participatory research.

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APPENDIX A

Personal Lifestyle and Health Status Questionnaire

PERSONAL

Name:____

Age: __________ Birthdate: ______________

Gender: __________

MARITAL STATUS

Married ☐ Single ☐ Divorced ☐ Separated ☐

OCCUPATION

Job Category: Management/Professional/Technical ☐ Administrative ☐

With respect to physical activity, how would you classify your work?

Very Active ☐ Reasonably Active ☐ Light ☐ Sedentary ☐

Is your job associated with mental stress?

Always ☐ Frequently ☐ Occasionally ☐ Seldom ☐ Never ☐

PHYSICAL ACTIVITY

How would you describe your present fitness level?

Excellent ☐ Good ☐ Fair ☐ Poor ☐

How often do you take part in physical activity?

☐ 5 - 7 times/week
☐ Monthly
☐ 3-4 times/week
☐ Occasionally
☐ 1-2 times/week
☐ Never

If your participation in physical activity is minimal (monthly, occasionally, never), what are the Reasons?

☐ Lack of Interest
☐ Ill Health
☐ Lack of Time
☐ Injury
☐ Lack of Facilities
☐Other____________________

SMOKING

Do you smoke? Yes ☐ Occasionally ☐ No ☐

If you are a daily smoker, specify the average number you smoke each day.

__________ Cigarettes
__________ Cigars
__________ Pipes

If you are an ex-smoker, how long ago did you quit?

__________ Months
__________ Years

NUTRITION

Do you select the recommended number of servings of food from the four food groups daily? (e.g. 2 servings from 'Milk or Milk Products'; 2 servings from 'Meat and Alternatives'; 3-5 servings from 'Breads and Cereals'; 5 servings from 'Fruits and Vegetables').

Always ☐ Frequently ☐ Occasionally ☐ Seldom ☐ Never ☐

Do you eat regular meals? (e.g. 2 or 3 meals consistently every day).

Always ☐ Frequently ☐ Occasionally ☐ Seldom ☐ Never ☐

Do you salt your food?

Always ☐ Frequently ☐ Occasionally ☐ Seldom ☐ Never ☐

Do you try to select foods containing polyunsaturated fats e.g. liquid vegetable oils, fish, poultry), rather than foods high in saturated fats? (meat, butter, cheese, cream, whole milk, chocolate).

Always ☐ Frequently ☐ Occasionally ☐ Seldom ☐ Never ☐

Do you frequently eat foods or beverages high in sugar content? (e.g. sweet desserts such as cakes, cookies, pastries, pop, fruit drinks).

Daily ☐ 2-3 times/week ☐ Weekly ☐ Monthly ☐ Never ☐

ALCOHOL

Do you drink alcohol? Yes ☐ Occasionally ☐ No ☐

If your response to the above question was yes, specify the number of drinks per week.

__________ Liquor (one drink = 1.5 ounces or one shot)
__________ Beer (one drink = 12 ounces or one bottle)
__________ Wine (one drink = 5 ounces or one glass)

CAFFEINE

Do you drink coffee and/or tea? Yes ☐ Occasionally ☐ No ☐

If your response to the above question was yes, specify the total number of cups per day.

__________ Coffee
__________ Tea

GENERAL HEALTH

How would you describe your present state of health?

Excellent ☐ Good ☐ Fair ☐ Poor ☐

Have you suffered any major injuries or illnesses? Yes ☐ No ☐

If your response to the above question was yes, how long ago?

__________ Months
__________ Years

Nature of Illness: ____

Present Limitations: ____

Have you undergone any major operations or surgery? Yes ☐ No ☐

If your response to the above question was yes, how long ago?

________ Months

________ Years

Nature of Surgery: ____________________

Present Limitations: ____________________

Do you have any back problems? Yes ☐ No ☐

If your response to the above question was yes,

have you seen a physician about your back? Yes ☐ No ☐

have you had x-rays taken of the area concerned? Yes ☐ No ☐

Present Limitations: ____________________

Do you take any prescription or non-prescription medication on a regular basis/high frequency? Yes ☐ No ☐

If your response to the above question was yes, specify the pharmaceutical name, the frequency and the dosage of each medication.

Pharmaceutical Name	Frequency (per day or week)	Dosage (mg)